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Research Product 88-37

Boresight Equipment Testing Procedures

July 1988

Fort Benning Field Unit
Training Research Laboratory

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U.S. Army Research Institute for the Behavioral and Social Sciences

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U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

**A Field Operating Agency Under the Jurisdiction
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Department of the Army

Litton Computer Services Division
Litton Systems, Inc.

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) As part of boresighting the 25-mm gun of the Bradley Fighting Vehicle (BFV), the turret technical manual (TM 9-2350-252-10-2) describes how to test the accuracy of the boresight telescope. However, BFV literature does not provide accuracy tests for the 25-mm boresight adapter or the 25-mm boresight kit (adapter plus telescope). This pamphlet describes testing procedures for the boresight telescope, 25-mm adapter, and kit. The kit test should be conducted prior to boresighting. Inaccurate kits should be reported through the chain of command to the battalion. When inaccurate kits are reported, master gunners conduct separate accuracy tests of telescopes and 25-mm adapters. Inaccurate telescopes and adapters are reported using the quality deficiency report. Accurate equipment is used to form accurate 25-mm boresight kits. Testing procedures in this pamphlet will be included in the BFV gunnery field manual (FM 23-1).			
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Boresight Equipment Testing Procedures

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FOREWORD

Since 1975 the Army Research Institute for the Behavioral and Social Sciences (ARI) has contributed to a program to define emerging problems and address critical issues affecting the Bradley Fighting Vehicle (BFV). Consistent with this mission, problem analysis indicated that fielded boresight equipment for the 25-mm gun was inaccurate. BFV boresight equipment was inaccurate because accuracy tests and standards for the 25-mm adapter and 25-mm boresight kit did not exist and telescope test TM 9-2350-252-10-2 did not assess the required standard. This research effort developed or modified accuracy testing procedures for the boresight telescope, 25-mm adapter, and 25-mm kit. This pamphlet, intended for BFV users, provides step-by-step procedures for testing 25-mm boresight equipment.

ARI's Fort Benning Field Unit, a division of the Training Research Laboratory, monitored this research. ARI's mission is to conduct research of training and training technology using infantry combat systems and problems as mediums. The research task that supports this mission, "Advanced Methods and Systems for Fighting Vehicle Training," is organized under the "Train the Force" program area. Sponsorship for this research is provided by a Memorandum of Understanding (effective 31 May 1983) between the U.S. Army Infantry School (USAIS), Training and Doctrine Command (TRADOC), Training Technology Agency, and ARI, which established how joint efforts to improve BFV tactical doctrine, unit, and gunnery training would proceed.

This pamphlet was fielded by USAIS during the 1987 USAIS Gunnery Conference. Major portions of the pamphlet will be included in the BFV gunnery field manual (FM 23-1, September 1987).



EDGAR M. JOHNSON
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BORESIGHT EQUIPMENT TESTING PROCEDURES

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BORESIGHT EQUIPMENT TESTING PROCEDURES

Section 1. Introduction

1.1 Requirement.

First-round hits with the 25-mm gun increase the lethality of the Bradley Fighting Vehicle (BFV). A first-round hit can lead to more kills for an upload of ammunition. The most important reason for first-round hits is to kill the enemy before he kills you.

First-round accuracy with the 25-mm gun requires accurate boresighting and zeroing. Boresighting is performed first to align the sights (integrated sight unit and auxiliary sight) with the aiming point of the 25-mm gun bore. Zeroing then aligns the sights with the point of round impact. With accurate boresighting, zeroing can be performed with only minor sighting adjustments and a minimum number of rounds.

Accurate boresighting will be critical in combat situations that make it difficult or impossible to zero. In this case, the level of sighting accuracy will depend on the accuracy of boresighting procedures and equipment. Boresight equipment must be tested for accuracy to insure that only the most accurate equipment is used.

1.2 Instructional Intent.

This pamphlet describes procedures to test the accuracy of equipment used to boresight the 25-mm automatic gun. This publication is designed as a self-contained training package for use at both the institutional and unit levels.

1.3 Publication Organization.

Section 2 describes the boresight equipment. Section 3 describes how the squad tests the accuracy of the 25-mm boresight kit (telescope used with a 25-mm adapter) before boresighting. Telescopes and adapters of inaccurate kits are then screened at the battalion level as described in Sections 4 through 6. Section 4 describes preparation for testing while Sections 5 and 6 describe how to screen adapters and telescopes, respectively. After accurate telescopes and 25-mm adapters are identified, Section 7 describes how to form accurate 25-mm kits. Section 8 reviews the sequence of testing procedures. Section 9 describes how to fill out quality deficiency reports (Standard Form 368) for defective or inaccurate boresight equipment.

Boresight testing procedures are summarized in Annexes written in a format similar to that used in the turret technical manual. Annex A summarizes the kit accuracy field test conducted by the squad. Annex B summarizes the procedures used by the battalion to test adapters and telescopes and to form accurate 25-mm boresight kits.

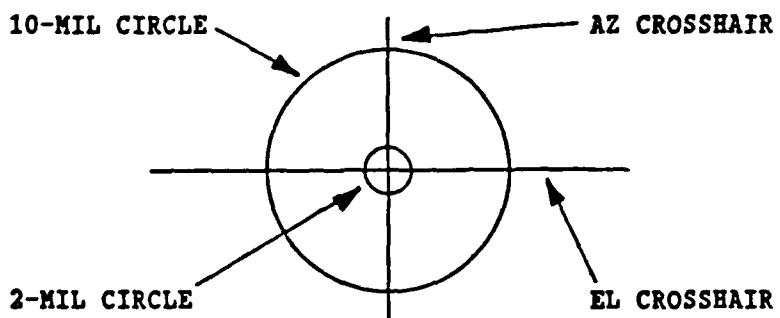
Section 2. Boresight Equipment

2.1 Introduction.

The 25-mm gun of the Bradley Fighting Vehicle (BFV) is boresighted with a boresight telescope (National Stock Number 4933-00-867-6607) and a 25-mm adapter. The adapter fits into the gun bore and the telescope is inserted into the adapter.

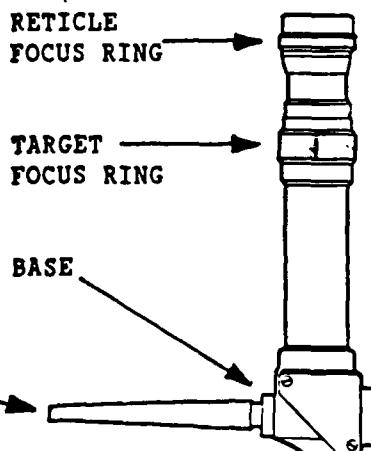
2.2 Boresight Telescope.

The reticle of the telescope is shown below. The reticle has CROSSHAIRS, a 2-MIL CIRCLE, and a 10-MIL CIRCLE. The AZIMUTH CROSSHAIR runs up and down while the ELEVATION CROSSHAIR extends from side to side. The 2-mil circle is used to test accuracy of the 25-mm boresight kit.



The telescope has a magnification of 5 power and can be focused on a target at distances from 5 meters to infinity. When properly focused, the aiming point of the reticle does not change even when the user moves his head while viewing through the eyepiece. Therefore, use of proper focusing procedures eliminates parallax in the telescope.

The telescope has two focusing rings. These rings must be adjusted in the correct order. First, the RETICLE FOCUS RING is used to FOCUS the RETICLE. It is best to point the telescope into the sky or any other evenly lit field of view; this prevents attempts to focus on a target instead of the reticle. To focus, turn the reticle focus ring until the reticle appears sharp and clear.



The TARGET FOCUS RING (called the vernier focus dial in TM 9-2350 252-10-2) is then used to FOCUS the TARGET. To adjust the target focus, the user turns the focus ring back and forth until the target is clearly focused. The focus is correct when the aiming point of the reticle does not change as the user moves his head back and forth above the eyepiece.

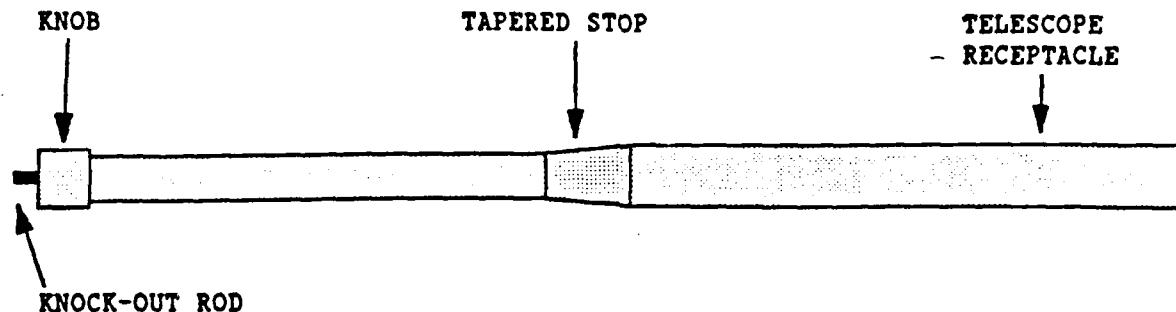
It is important to note that a sharp and clear image can be obtained if the two focusing rings are adjusted in the reverse order, that is, using the target focus ring before the reticle focus ring. However, use of this incorrect procedure can produce parallax (i.e., changes in the observer's head position will produce apparent movement of the reticle).

Parts of the telescope should not be unscrewed or disassembled. The telescope is not waterproof. If the telescope gets wet, it should be dried immediately. Water inside the telescope causes a foggy view.

A plate on the base of the telescope contains information that includes the Federal Ordnance Number and serial number. The serial number is the bottom number listed on the base.

2.3 The 25-mm Adapter.

A drawing of the 25-mm adapter (part number 12524010) is shown below. The KNOB is inserted into the 25-mm gun barrel. The adapter is fully inserted when the TAPERED STOP contacts the end of the gun barrel. The adapter should be inserted very slowly with a slight twisting motion to keep the adapter from "locking" in the barrel.



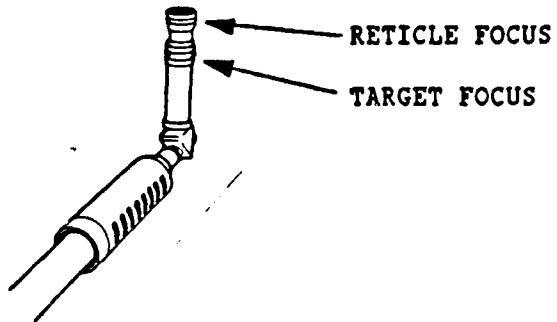
The telescope fits into the TELESCOPE RECEPTACLE of the adapter. When inserting the telescope, hold the telescope at the base without touching the glass lens. The telescope is firmly inserted by using a slight twisting motion. If the telescope gets stuck in the adapter, the user can gently hit the telescope KNOCK-OUT ROD. Hard hits on the rod may damage the shaft of the telescope.

A newly designed and fielded adapter (part number 12524144) is slightly different from shown above. A hardened plating is added to the tapered stop and knob to minimize wear. The knob has a larger diameter than the gun bore. Slots in the knob allow it to compress when inserted into the gun barrel. The newly designed adapter is usually more accurate than the original design.

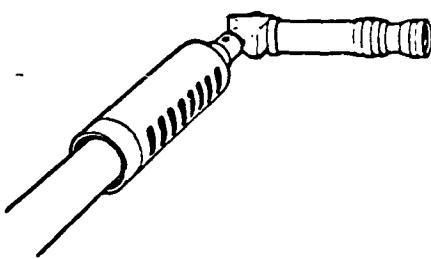
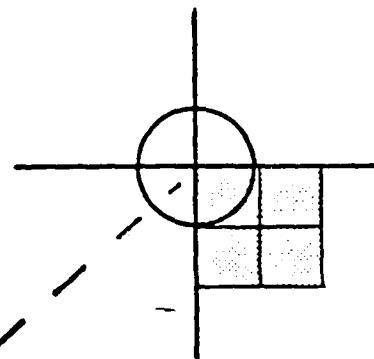
Section 3. Kit Accuracy Field Test

The 25-mm gun is boresighted with both the boresight telescope and 25-mm adapter. This 25-mm kit should always be tested for accuracy before the gun is boresighted. To prepare for testing, follow the first 16 steps described under the section BORESIGHT 25MM GUN in the turret technical manual (TM 9-2350-252-10-2). Accuracy of the kit is tested as described below instead of using Steps 17 through 21 of the technical manual.

1. FOCUS the telescope RETICLE using the RETICLE FOCUS RING.
2. FOCUS on the TARGET using the TARGET FOCUS RING.

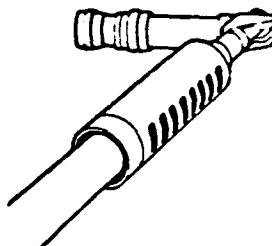


3. ROTATE the TELESCOPE so that the eyepiece is facing to the RIGHT.
4. INSTRUCT the GUNNER to LAY the GUN so that the telescope RETICLE is AIMED at a target with a CORNER (e.g., a boresight panel or building). The figure shows an 8-foot square boresight panel at 1200 meters.



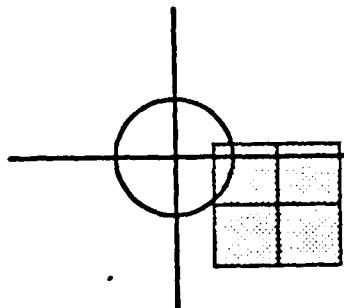
5. ROTATE the TELESCOPE and ADAPTER together 180 degrees until the telescope is facing to the LEFT.

NOTE: It may be necessary to hold the telescope in the adapter as it is rotated. This keeps the telescope from slipping within the adapter.

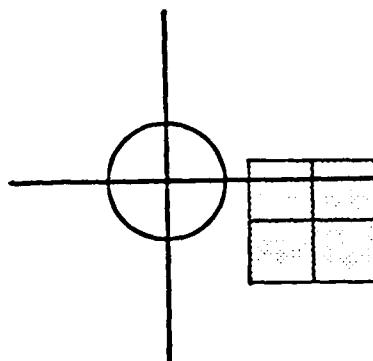


6. SCORE ACCURACY.

- A. STANDARDS are MET if the original AIMING POINT stays IN OR ON the 2-MIL CIRCLE of the telescope reticle.



- B. STANDARDS are NOT MET if the original AIMING POINT moves OUTSIDE the 2-MIL CIRCLE.



After an accurate kit has been identified, weapons are boresighted as described in the turret technical manual (TM 9-2350-252-10-2) beginning with Step 22.

The kit rotation test described in this pamphlet differs from the accuracy test written in the turret technical manual. The technical manual describes two 90-degree rotations of the telescope to test its accuracy. The 180-degree kit rotation test described in this pamphlet tests the entire kit.

Section 4. Preparing to Screen Equipment

4.1 Introduction.

A 25-mm boresight kit may be inaccurate because of the telescope or adapter or both. If a 25-mm kit does not meet standards of the Kit Accuracy Field Test, then the telescope and 25-mm adapter must be tested separately. If a large number of kits do not meet standards, then the battalion must screen all of its telescopes and 25-mm adapters. Accurate telescopes and adapters are then used to form accurate 25-mm kits which are returned to the squads. The following must be performed before equipment screening begins.

1. Designate testing personnel and a test BFV,
2. Designate a testing area,
3. Prepare and position a boresight test panel,
4. Learn use of the scoresheet, and
5. Aim the 25-mm gun at the center of the boresight test panel.

4.2 Designating testing personnel and a test BFV.

One BFV is used to test boresight equipment. The 25-mm gun barrel should have fired no more than 5000 rounds since gun erosion can affect testing results.

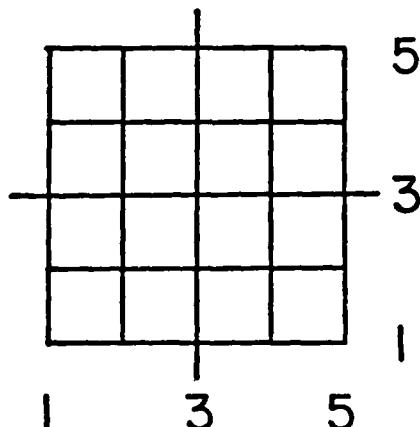
It is recommended that testing be conducted by two Master Gunners at either the company or battalion level. Testers should be thoroughly familiar with boresighting and have the ability to accurately obtain, record, and score the boresight data. One tester observes aiming points of tested equipment and the other tester records data on a standardized scoresheet. Testers should alternate between testing and recording to prevent eye strain from using the telescope for long periods. It may take from 3 to 5 days to screen all boresight equipment in a battalion.

4.3 Designating a testing area.

Testing should be conducted close to where the boresight equipment is stored or secured to facilitate movement of equipment to and from the test vehicle. A 52-meter line of sight is required from the end of the 25-mm gun barrel to the test panel. Testing materials and equipment can be stowed in the test vehicle overnight. This makes it easier to set up for testing at the beginning of each day.

4.4 Preparing a boresight test panel.

A special test panel is used to test the equipment. The panel is a 4 by 4 SCORING GRID of 2-inch squares. A reduced drawing of the panel is shown on the right. EACH SQUARE of the scoring grid is 1-MIL HIGH and WIDE when the panel is placed 52 m from the end of the 25-mm gun barrel. This grid allows the tester to observe the location of the boresight aiming point. The aiming point is then recorded on a scoresheet that has drawings of the grid.



A half-scale drawing of the scoring grid for the test panel is provided in Appendix A of Annex B. The drawing can be waterproofed like a map and stapled to a piece of plywood for use as a test panel. The panel is placed 52 m from the end of the gun barrel. A fence or any other rigid structure can be used to support the panel. It should be tied to the support structure so that the panel does not get knocked down by wind. The panel can be placed on the ground in the upright position; it does not have to be at gun level.

4.5 Learning to use the scoresheet.

A standardized scoresheet is used to record and score boresight data. A reduced copy of the Boresight Equipment Scoresheet is presented on the next page. A full sized copy of the scoresheet is provided in Appendix B of Annex B. This can be removed from the pamphlet and copied for use during testing. The scoresheet is used to screen all equipment--adapters, telescopes, and 25-mm boresight kits.

The INFORMATION SECTION at the top of the scoresheet is used to record when testing occurred, who did it, the equipment tested, and the results (pass or fail) of the test. Test data is recorded in the two blocks labelled TEST 1 and TEST 2. There are two TEST blocks because equipment is tested twice. A GO score must be received on both tests for equipment to PASS the screening test.

Before testing begins, it is important to learn how to record and plot boresight aiming points on the scoresheet. This will be described next.

APPENDIX B. BORESIGHT EQUIPMENT SCORESHEET

DATE: _____	TIME: _____	TEST TYPE: TEL. / ADP. / KIT
TESTER: _____	TEL. NO. _____	ADP. NO. _____
UNIT: _____	PASS / FAIL (Pass requires a GO on TESTS 1 & 2)	

TEST 1

DATA SECTION 1

RT AIMPOINT COOR: AZ _____ EL _____

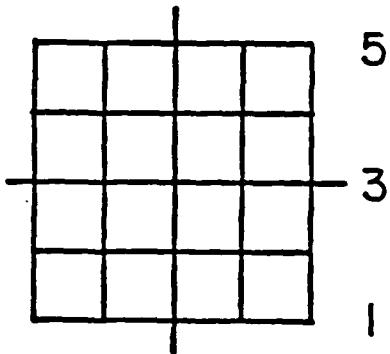
LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE
BETWEEN AIMPOINTS (IN) _____

DISTANCE IN MILS
BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

SCORING GRID 1



1 3 5

TEST 2

DATA SECTION 2

RT AIMPOINT COOR: AZ _____ EL _____

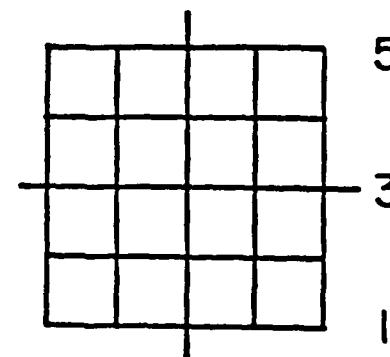
LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE
BETWEEN AIMPOINTS (IN) _____

DISTANCE IN MILS
BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

SCORING GRID 2



1 3 5

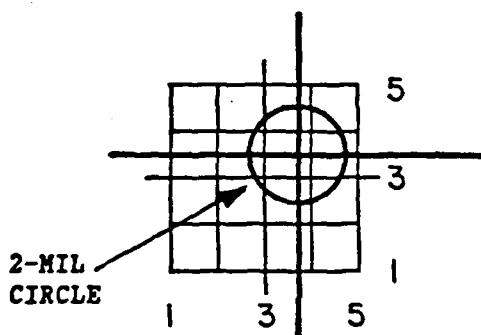
INCH TO MIL CONVERSION TABLE FOR THIS SCORESHEET

INCHES	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1
MILS	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2

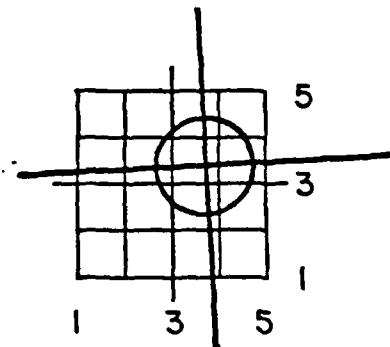
NOTE: GO Score is 1 mil or less.

The telescope reticle must be aligned with the scoring grid of the test panel before a aiming point is recorded. If there is incorrect alinement then the boresight equipment can be rotated until the correct sight picture is obtained.

CORRECT RETICLE ALINEMENT

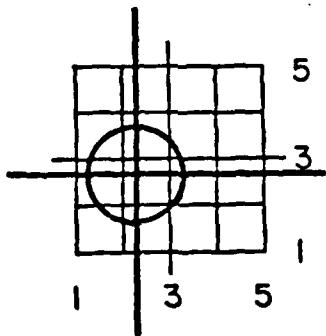


INCORRECT RETICLE ALINEMENT

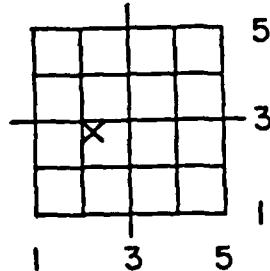


The aiming point of the telescope can be determined using one of two techniques. For one technique, the tester draws an "X" on the scoring grid of the scoresheet where the telescope reticle is aiming at the panel. Use of this technique may be difficult for some testers because of the "clutter" between the reticle and grid lines.

SIGHT PICTURE



SCORING GRID OF SCORESHEET

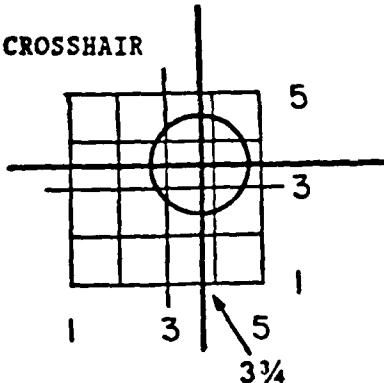


A second technique for observing and plotting aiming points is similar to using grid coordinates on a map. Numbers along the bottom and right side of the test panel are used to read "grid coordinates" for each aiming point. Very simply, COORDINATES are READ to the RIGHT and UP starting from the lower left-hand corner of the grid. There are two readings for each aiming point of the telescope--an azimuth (AZ) coordinate and an elevation (EL) coordinate.

The AZ coordinate is read where the AZ crosshair crosses the scale at the bottom of the grid. The AZ coordinate for the example is $3 \frac{3}{4}$. This is recorded as the RT AIMPOINT COOR in the DATA SECTION of the scoresheet.

SIGHT PICTURE

AZ CROSSHAIR



DATA SECTION OF SCORESHEET

RT AIMPOINT COOR: AZ $3 \frac{3}{4}$ EL _____

LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE BETWEEN AIMPOINTS (IN) _____

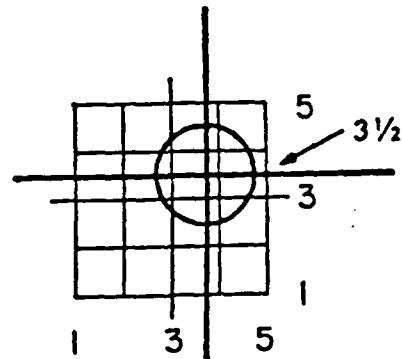
DISTANCE IN MILS BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

The EL coordinate is read where the EL crosshair crosses the right side of the grid. The EL coordinate is $3 \frac{1}{2}$ in the example and is recorded as the RT AIMPOINT COORDINATE in the DATA SECTION of the scoresheet.

SIGHT PICTURE

EL CROSSHAIR



DATA SECTION OF SCORESHEET

RT AIMPOINT COOR: AZ $3 \frac{3}{4}$ EL $3 \frac{1}{2}$

LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE BETWEEN AIMPOINTS (IN) _____

DISTANCE IN MILS BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

Plot the aiming point on the SCORING GRID of the scoresheet. In this case, go right $3 \frac{3}{4}$ mils and up $3 \frac{1}{2}$ mils.

DATA SECTION 1

RT AIMPOINT COOR: AZ $3 \frac{3}{4}$ EL $3 \frac{1}{2}$

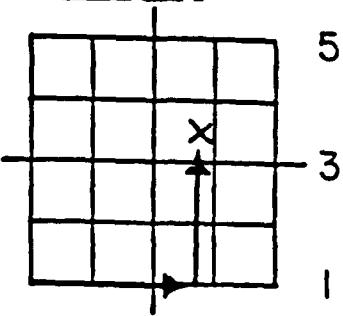
LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE BETWEEN AIMPOINTS (IN) _____

DISTANCE IN MILS BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

SCORING GRID 1



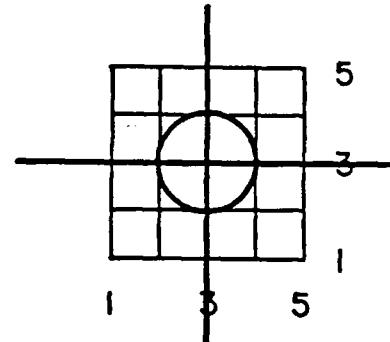
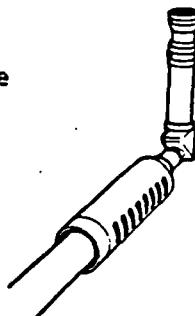
Two testers can practice recording boresight aiming points with this technique by laying the 25-mm gun on different parts of the test panel. Testers should practice observing and recording the AZ and EL coordinates for the same aiming point. Testers should be able to obtain AZ and EL readings to at least the nearest 1/4 of a mil. However, optimal testing results are obtained with aiming point accuracy readings taken to the nearest 1/8 mil.

4.6 Aiming at the center of the test panel.

The gun should be aimed near the center of the test panel before testing begins. This makes it more likely that aiming points will be located on the grid during testing. Aiming points not on the grid are difficult to record and score.

Accurate gun lay can be performed with a Wild-Heerbrugg boresight kit, if one is available. Otherwise, gun lay is performed with issued boresight equipment using the following procedure. The gun- lay procedure is performed in manual mode of turret operation. A Boresight Equipment Scoresheet and pencil is required.

1. INSERT ADAPTER into gun barrel.
2. INSERT TELESCOPE into adapter with the EYEPIECE facing UP.
3. Instruct gunner to LAY the GUN so that TELESCOPE RETICLE AIMS at the CENTER OF PANEL.
4. FOCUS TELESCOPE.
 - A. FOCUS the RETICLE using the RETICLE FOCUS RING.
 - B. FOCUS on the TARGET using the TARGET FOCUS RING.



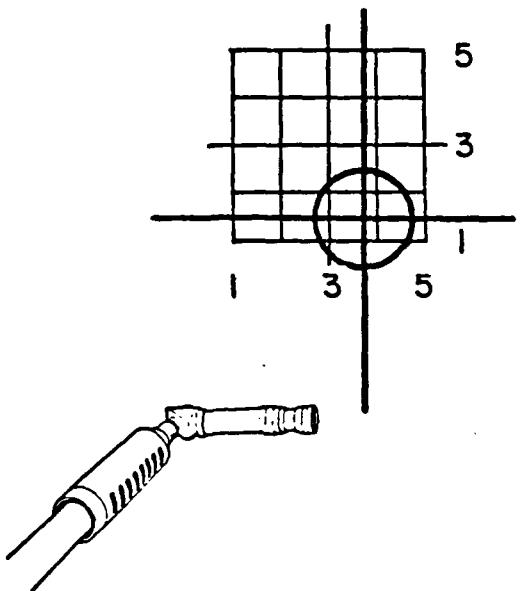
5. Instruct the gunner to LAY the GUN until the telescope RETICLE is AIMING at the CENTER OF PANEL, if necessary.

NOTE: It may be necessary to make minor changes in the lay of the gun after target focusing during Step 4.

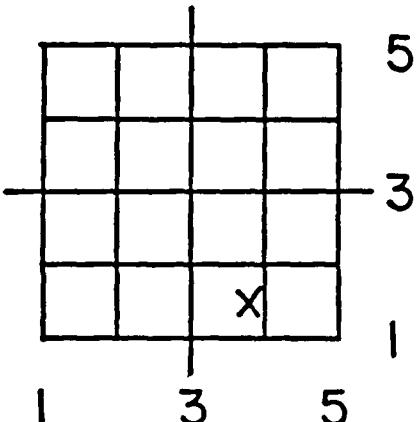
The telescope is now aiming at target center, but the gun will not be aiming at target center if the boresight equipment is inaccurate. For this reason, the following procedure is performed.

6. ROTATE the KIT (telescope plus adapter) until the EYEPIECE is facing to the RIGHT.
7. MARK the AIMING POINT on a SCORING GRID of the scoresheet.

SIGHT PICTURE

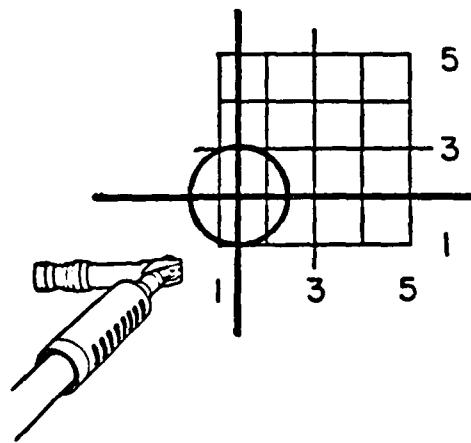


SCORESHEET

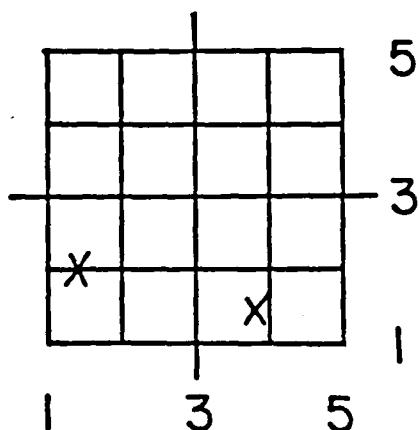


8. ROTATE the KIT until the telescope EYEPIECE is facing LEFT.
9. MARK the LEFT AIMING POINT on a SCORING GRID of the scoresheet.

SIGHT PICTURE



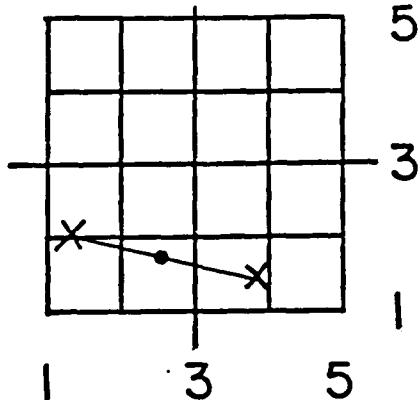
SCORESHEET



Taking right and left aiming points during Steps 6 through 9 is like using a shot group to zero a weapon. Step 10 will determine the middle of the two aiming points to estimate where the gun is actually aiming. The gun is then laid on estimated center of panel during Step 11.

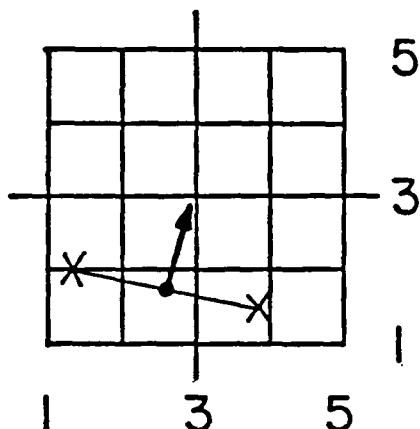
10. DETERMINE AIMING POINT of GUN.

- A. DRAW a LINE between the two AIMING POINTS marked on the scoresheet.
- B. MARK the MIDDLE of the LINE. This is where the gun is actually aiming.

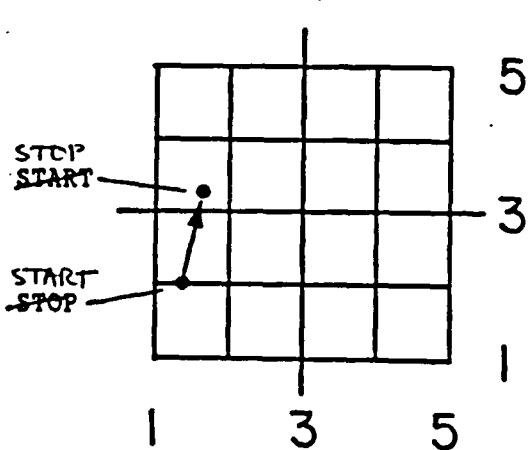


11. LAY GUN on estimated CENTER OF PANEL.

- A. DRAW an ARROW from the MIDDLE of the LINE to the CENTER OF PANEL. The arrow shows the distance and direction of the gun from target center.



- B. Instruct gunner to LAY the GUN the DISTANCE and DIRECTION shown by the ARROW.



The example shows the start and stop points of a gun lay with the telescope starting in the left position. In this case, the gun was moved about 1 1/4 mils in the 1 o'clock direction. The gun lay can be performed with the telescope in any position (left, up, or down), but the gun is moved the same distance and direction no matter where the starting location is.

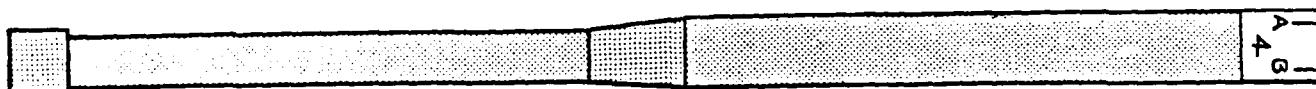
Section 5. Adapter Screening Test

5.1 Finding a New or Accurate Telescope.

Adapters are tested first using an accurate telescope. New telescopes usually meet accuracy requirements, so obtain a new telescope if possible. A new telescope can be obtained from a new vehicle or from direct exchange for a defective telescope. A new telescope will be easy to identify if it is still wrapped in shipping material. However, a new telescope may have been unwrapped but still unused. These can be identified since there may still be tape over the eyepiece. A telescope can be inspected for scratches, dirt, and fingerprints on lens to estimate prior use.

5.2 Marking Adapters.

Adapters must be marked prior to screening. A piece of 1-inch wide masking tape is wrapped around the telescope end of the adapter. POSITION MARKS are made on the tape (a) to ALIGN the ADAPTER in the BARREL and (b) to ALIGN the TELESCOPE WITH THE ADAPTER. An ADAPTER MARKING TEMPLATE can be used to help make the Position Marks. A copy of the template is reproduced on page B-7 of Annex B. This template can be cut out and taped to the clipboard used to hold scoresheets during testing. The telescope-end of the adapter is placed on the template and the position marks.



Adapters have no permanent identification marks, so an ID number must be added to each adapter. An identification number for each adapter is then marked on the tape. The sample adapter above is numbered with a 4.

5.3 Ready to Test.

Testing begins when the vehicle is in place, the panel is in position, the gun is aiming at the panel, the adapters are marked, an accurate telescope is available, and the data recorder has a set of scoresheets and a clip board.

5.4 Recording Background Information on the Scoresheet.

Before testing each piece of equipment, one tester must record the date, time, tester, unit, test type, telescope serial number, and adapter number on the scoresheet. A completed INFORMATION SECTION of the scoresheet is shown below. The test type shows whether an adapter, telescope, or kit is being tested.

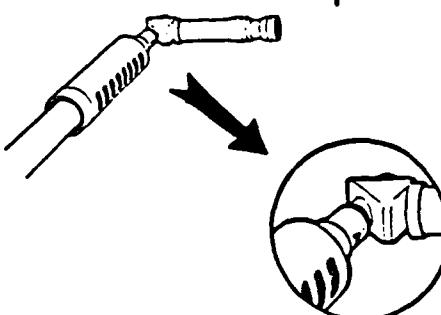
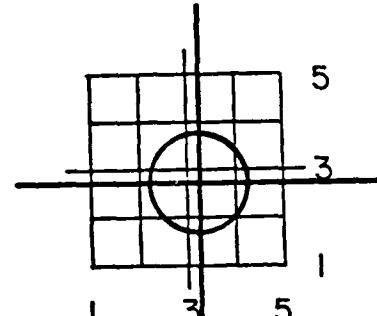
BORESIGHT EQUIPMENT SCORESHEET		
DATE: <u>10-6-PL</u>	TIME: <u>0832</u>	TEST TYPE: TELESCOPE / <u>ADAPTER</u> / KIT
TESTER: <u>SFC JONES</u>	TEL. NO. <u>3022</u>	ADAPTER NO. <u>4</u>
UNIT: <u>1/29</u>	PASS / FAIL (Pass requires a GO on TESTS 1 & 2)	

5.5 Conducting the Test.

Adapters are tested using the kit rotation procedure used for the Kit Accuracy Field Test. Testing begins with the telescope facing right. The aiming point of the reticle is observed and recorded on the scoresheet. The adapter and telescope are then rotated together one-half turn (180 degrees) until the eyepiece is facing left. This aiming point is then recorded on the scoresheet. Scoring of equipment accuracy will be described in Section 5.6.

Each adapter is given two iterations of the test to provide a more reliable estimate of accuracy. Data for the first test are recorded in the TEST 1 section of the scoresheet and the second test is recorded in the TEST 2 section. The only difference between Tests 1 and 2 is the position of the adapter in the gun barrel. The following describes a sample test.

1. INSERT the 25-mm ADAPTER into the gun barrel with POSITION MARK A facing RIGHT.
2. INSERT TELESCOPE into adapter with the EYEPIECE facing RIGHT.
3. ESTIMATE AZ COORDINATE and EL COORDINATE for the AIMING POINT. The AZ coordinate for the example is 3 1/4 and the EL coordinate is 2 3/4.



4. RECORD the AZ COORDINATE and the EL COORDINATE in the RT AIMPOINT COOR item of SCORING GRID 1 of the scoresheet.
5. PLOT the RT AIMING POINT for Test 1 on SCORING GRID 1 of the scoresheet.

TEST 1

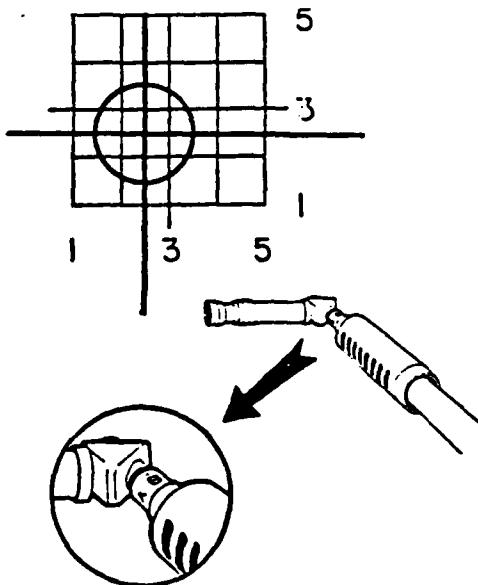
<p>DATA SECTION 1</p> <p>RT AIMPOINT COOR: AZ <u>3 1/4</u> EL <u>2 3/4</u></p> <p>LT AIMPOINT COOR: AZ _____ EL _____</p> <p>MEASURED DISTANCE BETWEEN AIMPOINTS (IN) _____</p> <p>DISTANCE IN MILES BETWEEN AIMPOINTS _____</p> <p>SCORE: GO / NO GO</p>	<p>SCORING GRID 1</p>
--	------------------------------

It is best to plot an aiming point after its AZ and EL coordinates are recorded in the data section of the scoresheet. The following technique is recommended for recording aiming points when two testers are collecting data. The tester observing the aiming point reads the AZ and EL coordinates to the other tester who records them on the scoresheet. The observer takes the scoresheet and plots the aiming point on the scoring grid using the AZ and EL data. The observer compares the scoresheet and sight picture to make sure that the aiming points were accurately recorded.

Now that the right reading of TEST 1 is completed, the left reading must be taken.

6. ROTATE both the TELESCOPE and ADAPTER until the EYEPIECE is FACING LEFT.

NOTE: It is important to maintain the position of the telescope in the adapter during kit rotation. If the telescope slips in the adapter when the kit is rotated, then make sure that POSITION MARK A of the adapter is facing left before the aiming point is recorded.



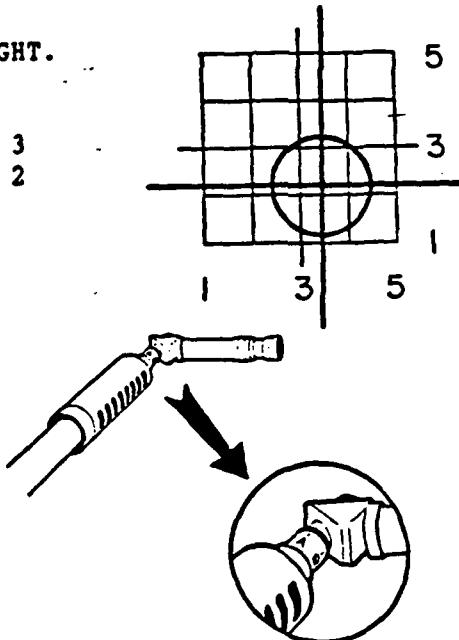
7. RECORD the AZ COORDINATE and EL COORDINATE of the aiming point in LT AIMPOINT COOR in DATA SECTION 1 of the scoresheet. For the example, the AZ coordinate is $2\frac{1}{2}$ and the EL coordinate is $2\frac{3}{4}$.
8. PLOT the LT AIMING POINT for Test 1 on SCORING GRID 1 of the scoresheet.

TEST 1

<p><u>DATA SECTION 1</u></p> <p>LT AIMPOINT COOR: AZ <u>$3\frac{1}{4}$</u> EL <u>$2\frac{3}{4}$</u></p> <p>LT AIMPOINT COOR: AZ <u>$2\frac{1}{2}$</u> EL <u>$2\frac{1}{2}$</u></p> <p>MEASURED DISTANCE BETWEEN AIMPOINTS (IN) _____</p> <p>DISTANCE IN MILES BETWEEN AIMPOINTS _____</p> <p>SCORE: GO / NO GO</p>	<p><u>SCORING GRID 1</u></p>
--	------------------------------

TEST 1 of the adapter is now completed. TEST 2 will now be described. TEST 2 is just like TEST 1 except that the telescope is aligned with POSITION MARK B on the adapter prior to testing.

9. ROTATE the ADAPTER until POSITION MARK B is facing RIGHT.
10. ROTATE the TELESCOPE to the RIGHT. The AZ coordinate is $3\frac{1}{2}$ and the EL coordinate is $2\frac{1}{4}$ in this example.



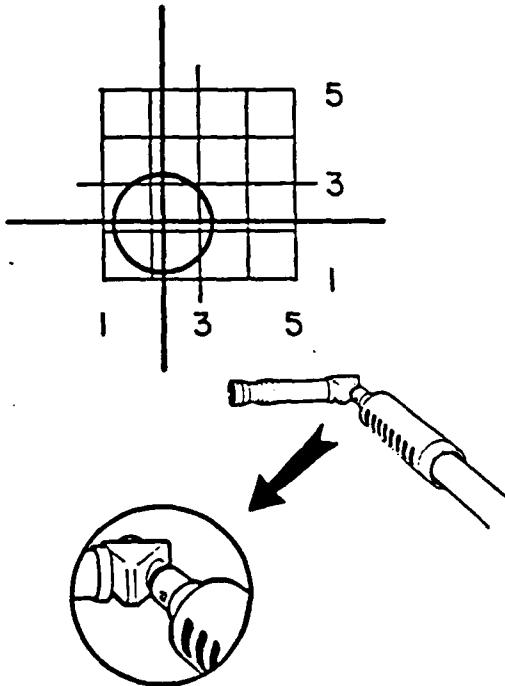
11. ESTIMATE and RECORD the AZ and EL COORDINATES in the RT AIMPOINT COOR item of DATA SECTION 2 of the scoresheet.

12. PLOT the RT AIMPOINT on SCORING GRID 2 of the scoresheet.

TEST 2

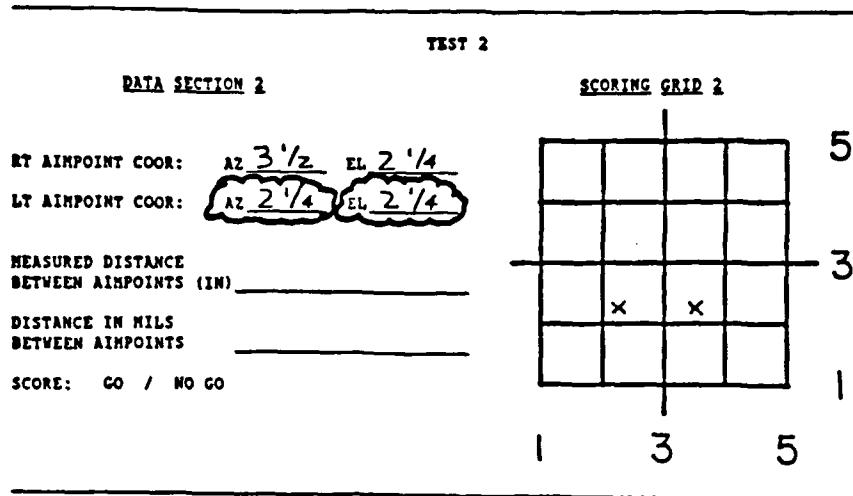
DATA SECTION 2		SCORING GRID 2	
RT AIMPOINT COOR:	AZ <u>3 1/2</u> EL <u>2 1/4</u>		
LT AIMPOINT COOR:	AZ _____ EL _____		
MEASURED DISTANCE BETWEEN AIMPOINTS (IN)	_____		
DISTANCE IN MILS BETWEEN AIMPOINTS	_____		
SCORE: GO / NO GO			

13. ROTATE both the ADAPTER and TELESCOPE to the LEFT.
POSITION MARK B of the adapter should be facing LEFT. AZ and EL coordinate readings are 2 1/2 and 2 1/4, respectively.



14. ESTIMATE and RECORD the AZ and EL COORDINATES in LT AIMPOINT COOR in DATA SECTION 2 of the scoresheet.

15. PLOT the LT AIMPOINT on SCORING GRID 2 of the scoresheet.



Data collection for one adapter is now completed. Testing continues until all adapters from one company are tested. Testing one adapter takes about 2 to 4 minutes per piece, so 13 adapters in a company can be tested in about 1 hour. Adapters are tested one company at a time until all equipment in the battalion is tested. Adapters are then scored.

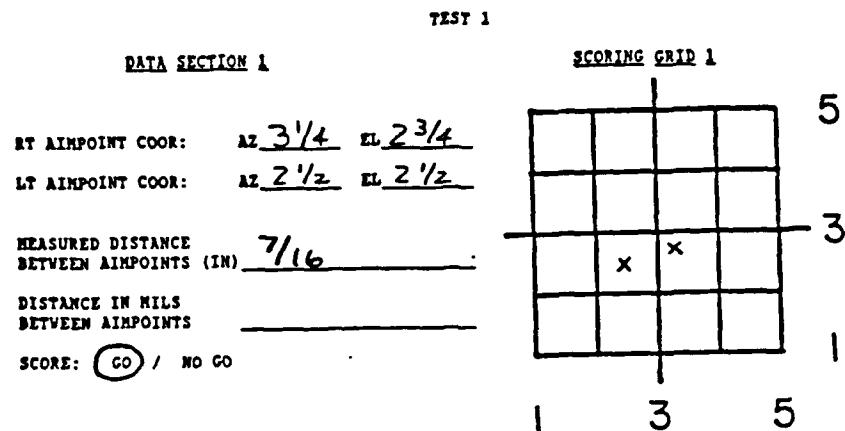
5.6 Scoring the Adapter Data.

The distance between the two aiming points during an iteration of a test is used as a measure of accuracy. To receive a GO score, there must be 1 mil or less between the two aiming points. The SCORING GRID on the scoresheet is scaled so that 1 mil is $1/2$ inch long. A standard ruler is used to measure the distance between points. The distance must be $1/2$ inch or less for a GO score. GOs must be scored on both TEST 1 and TEST 2 for an adapter to PASS the screening test. A step by step description of scoring is given below. The previous sample data will be scored.

1. OBTAIN a RULER that has MARKINGS every $1/16$ th of an INCH. A $1/16$ scale allows measurement to the nearest $1/8$ mil of the scoresheet.
2. MEASURE the DISTANCE between the TWO AIMING POINTS MARKED on SCORING GRID 1. The distance in this example is $7/16$ inches.
3. RECORD the MEASURED DISTANCE in the DISTANCE BETWEEN AIMPOINTS item of DATA SECTION 1.

4. SCORE TEST 1.

- CIRCLE GO in DATA SECTION 1 if DISTANCE is 1/2 INCH OR LESS.
- CIRCLE NO GO in DATA SECTION 1 if DISTANCE is MORE than 1/2 INCH.

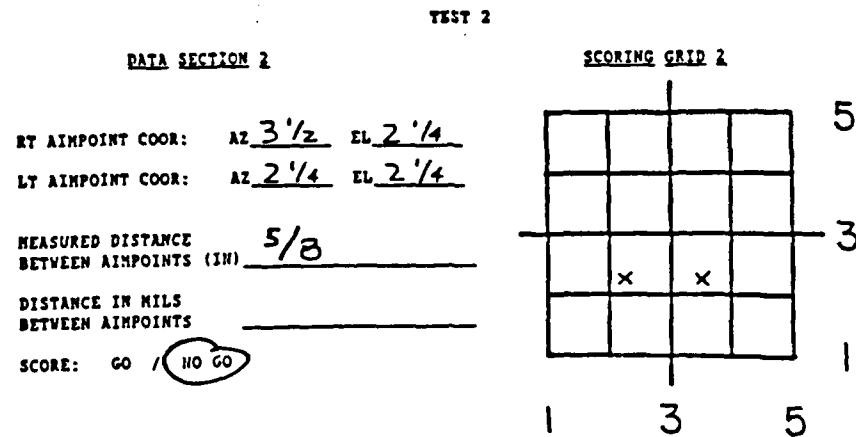


5. MEASURE the DISTANCE between AIMING POINTS marked on SCORING GRID 2. The distance in this example is 5/8 inches.

6. RECORD the DISTANCE in the DISTANCE BETWEEN AIMPOINTS item of DATA SECTION 1.

7. SCORE TEST 2.

- CIRCLE GO in DATA SECTION 1 if DISTANCE is 1/2 INCH OR LESS.
- CIRCLE NO GO in DATA SECTION 1 if DISTANCE is MORE than 1/2 inch.



8. SCORE the SCREENING TEST.

- A. CIRCLE PASS at top of scoresheet if TEST 1 & TEST 2 are GOs.
- B. CIRCLE FAIL at top of scoresheet if:
- TEST 1 is a NO GO
 - TEST 2 is a NO GO
 - TEST 1 and 2 are NO GOs.

A reduced copy of the completed scoresheet for the sample data is presented below. The adapter received a GO score for TEST 1 and a NO GO score for TEST 2. Therefore, the sample adapter failed the screening test.

BORESIGHT EQUIPMENT SCORESHEET

DATE: <u>10-6-PL</u>	TIME: <u>0832</u>	TEST TYPE: TELESCOPE / <u>ADAPTER</u> / KIT
TESTER: <u>SFC JONES</u>	TEL. NO. <u>3022</u>	ADAPTER NO. <u>4</u>
UNIT: <u>1/29</u>	PASS / FAIL (Pass requires a GO on TESTS 1 & 2)	

TEST 1

DATA SECTION 1

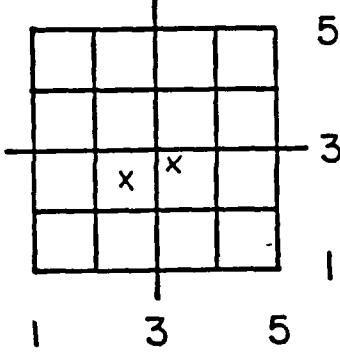
RT AIMPOINT COOR: AZ 3 1/4 EL 2 3/4
 LT AIMPOINT COOR: AZ 2 1/2 EL 2 1/2

MEASURED DISTANCE
BETWEEN AIMPOINTS (IN) 7/16

DISTANCE IN MILS
BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

SCORING GRID 1



TEST 2

DATA SECTION 2

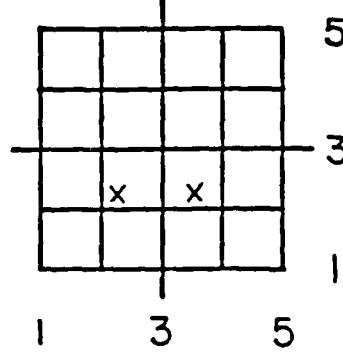
RT AIMPOINT COOR: AZ 3 1/2 EL 2 1/4
 LT AIMPOINT COOR: AZ 2 1/4 EL 2 1/4

MEASURED DISTANCE
BETWEEN AIMPOINTS (IN) 5/8

DISTANCE IN MILS
BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

SCORING GRID 2



Section 6. Telescope Screening Test

6.1 Finding an Accurate Adapter.

Telescopes are tested for accuracy when paired with a highly accurate adapter identified after screening of adapters. The most accurate adapter has the shortest distance between right and left aiming points during testing.

6.2 Marking Telescopes.

Each telescope has a serial number stamped on the base plate near the shaft. The serial number can be marked on tape placed on the 7.62-mm boresight kit container. Marking the case makes it easier to sort accurate and inaccurate telescopes after testing.

6.3 Conduct of Testing.

Telescopes are tested using the telescope rotation procedure. After the good adapter is inserted into the gun barrel, the telescope is inserted with the eyepiece facing to the right. The aiming point is observed and recorded on the scoresheet. Only the telescope is rotated until the eyepiece is facing to the left. The telescope passes standards if the aiming point changes 1 mil or less after telescope rotation. Each telescope must meet the standard on two iterations of the test procedure to pass the screening test.

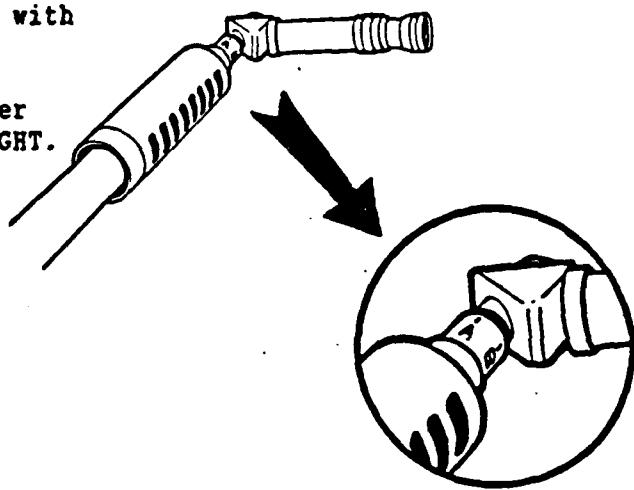
The following describes the screening procedure for telescopes. Sample data are not provided since data recording, plotting, and scoring are the same as for adapters (see Sections 5.5 and 5.6).

1. RECORD date, time, tester, unit, telescope serial number, adapter assigned number, and test type in INFORMATION SECTION of scoresheet

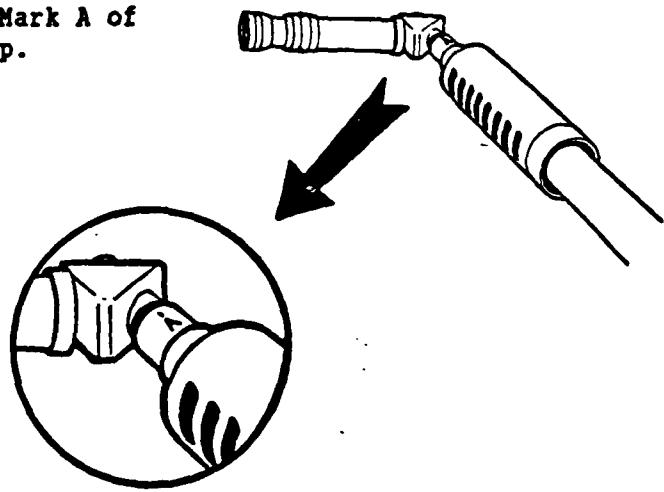
BORESIGHT EQUIPMENT SCORESHEET

DATE: <u>10-8-86</u> TIME: <u>1315</u>	TEST TYPE: <u>TELESCOPE</u> / ADAPTER / KIT
TESTER: <u>SFC SMITH</u>	TEL. NO. <u>6047</u> ADAPTER NO. <u>32</u>
UNIT: <u>1/29</u>	PASS / FAIL (Pass requires a GO on TESTS 1 & 2)

2. INSERT a HIGHLY ACCURATE 25-mm ADAPTER into the GUN BARREL with POSITION MARK A facing UP.
3. INSERT TELESCOPE into adapter with the eyepiece facing RIGHT.



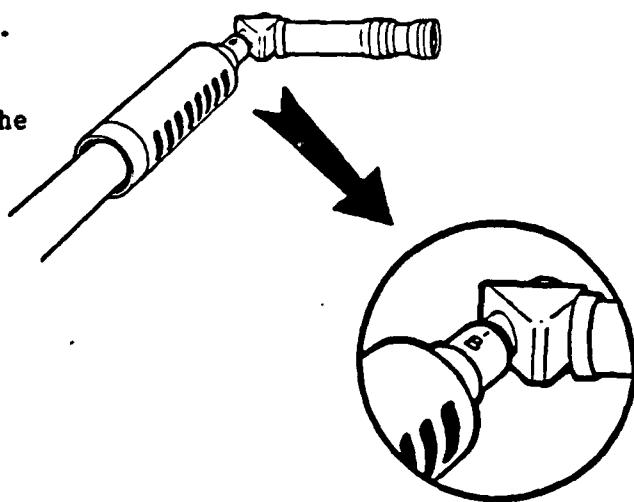
4. RECORD AZ & EL COORDINATES in the RT AIMPOINT COOR item of DATA SECTION 1 of the scoresheet.
5. PLOT the RT AIMPOINT on SCORING GRID 1 of the scoresheet.
6. ROTATE only the TELESCOPE 180 DEGREES so that the EYEPiece is facing LEFT. Position Mark A of the adapter is facing up.



7. RECORD the AZ & EL COORDINATES in the LT AIMPOINT COOR item of DATA SECTION 1.
8. PLOT the LT AIMPOINT on SCORING GRID 1 of the scoresheet.

TEST 1 is now completed. TEST 2 will now be described. TEST 2 is like TEST 1 except that POSITION MARK B faces up.

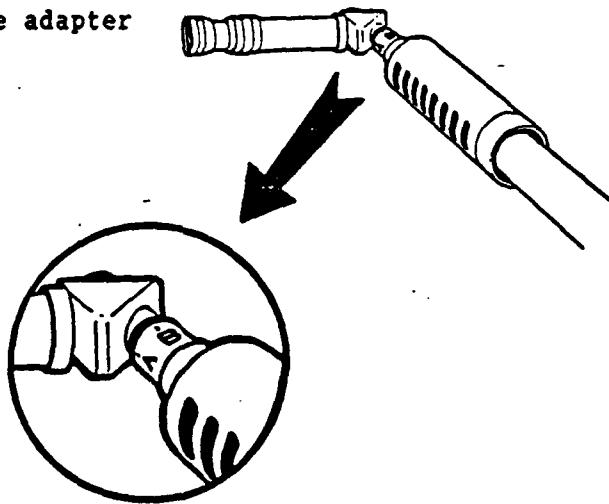
9. ROTATE the ADAPTER until POSITION MARK B is facing UP.
10. ROTATE the TELESCOPE to the RIGHT. Position Mark B of the adapter still is facing up.



11. RECORD RT AIMPOINT in DATA SECTION 2 of the scoresheet.

12. PLOT RT AIMPOINT on SCORING GRID 2 of scoresheet.

13. ROTATE TELESCOPE to the LEFT. Position Mark B of the adapter is facing up.



14. RECORD AIMPOINT in the LT AIMPOINT COOR item of DATA SECTION 2.

15. PLOT LT AIMPOINT on SCORING GRID 2 of scoresheet.

Testing for one telescope is now completed. Testing should continue until all telescopes within the battalion are tested.

6.4 Scoring the Telescope Data.

Scoring is conducted after accuracy data are collected for all telescopes. Scoring procedures are the same as for adapters (see Section 5.6). A GO score is given on an iteration of the test procedure when the distance between right and left aiming points is 1/2 inch or less on the SCORING GRID of the scoresheet. A PASS on the screening test requires a GO score on both iterations of the test procedure. The telescope fails the screening test if A NO GO score is received on one or both rotation tests. PASS or FAIL is circled in the Information Section of the scoresheet.

Section 7. Forming 25-mm Boresight Kits

The final objective is to form accurate 25-mm boresight kits from telescopes and 25-mm adapters that are accurate. Kits are screened using the same procedure and standard used for adapters--the kit rotation procedure with a 1-mil standard. To screen kits, adapters and telescopes meeting their standards are paired and tested. Accurate kits are reissued to the squad.

Before kits are screened, testing of adapters (see Section 5) and telescopes (see Section 6) may identify more adapters than telescopes that meet standards. In this case, the number of accurate kits that can be formed is limited by the number of accurate adapters.

If more telescopes than adapters meet standards, then testing of kits begins using telescopes that are the most accurate. These telescopes will be noticeably more accurate than their standard requires. The most accurate telescopes are those with the lowest DISTANCE BETWEEN RT & LT READINGS during an iteration of a test.

After an accurate kit is formed, it is important to keep the adapter and telescope together. The serial number of the telescope can be etched on the adapter using an electrical etching tool.

Section 8. Summary

Before the 25-mm gun is boresighted, the squad should conduct the Kit Accuracy Field Test for the the 25-mm boresight kit. A kit not meeting standards is returned to the company which then reports the inaccurate kit to the battalion. If a large number of inaccurate kits are reported, then Master Gunners within the battalion must screen 25-mm adapters and telescopes. Telescopes and 25-mm adapters not meeting standards are reported using the Quality Deficiency Report (QDR). Telescopes and 25-mm adapters meeting standards are used to form accurate 25-mm kits. The telescope and adapter of accurate kits are marked so that the components will be used together. After equipment is screened and accurate kits are formed, screening tests are required only when (a) new equipment is obtained and (b) used equipment does not pass the Kit Accuracy Field Test.

Annex A summarizes the Kit Accuracy Field Test. Annex B summarizes the screening of 25-mm boresight equipment. Screening is divided into 4 phases: Testing Preparation, Screening Adapters, Screening Telescopes, and Forming Kits. Each phase has 3 or 4 subtasks and the annex includes a summary of each one of these. The subtasks are:

- A. Prepare and position the boresight test panel.
- B. Boresight aiming-point recording procedure.
- C. Lay the gun on the center of the test panel.
- D. Adapter marking procedures.
- E. Adapter and kit screening procedure.
- F. Telescope screening procedure.
- G. Boresight equipment scoring procedure.

Section 9. Quality Deficiency Reports

Telescopes and 25-mm adapters not passing the screening tests described in this pamphlet must be reported using Standard Form 368, the Quality Deficiency Report (QDR). A blank copy of the QDR is shown on the following page. You only need to fill out Section I because Section II is filled out by the people indicated in Block 2a.

Separate QDRs could be completed for each defective piece of equipment, however, it is easier to fill out a single QDR for all defective/inaccurate telescopes and a second GDR for inaccurate adapters. The following is a sample QDR for reporting defective and inaccurate telescopes. The information for this sample QDR is typed, but the SF 368 can be hand written.

Block 1a. The QDR should be filled out by the Battalion Master Gunner. Enter your unit and address to include the zip code (or APO number) and the Department of Defense Activity Address Code (DODAAC).

Block 1b. This block has the name of the person filling out the QDR, his phone number (use AV for AUTOVON and FTS for commercial numbers), and signature.

Block 2a. The sample QDR shows the name and address of the manager who will receive the QDR. Your QDR should have Block 2a filled out as shown below.

Block 2b. Leave this block blank.

SECTION I	
1a. From (Originating point) Commander, 1/29th INF ATTN: BN Master Gunner, SFC John C. Smith Fort Benning, GA 31905 W33RQH	2a. To (Screening point) Commander, US AMCCOM ATTN: AMSMC-QAD Rock Island, IL 61299
1b. Typed Name, Duty, Phone and Signature John C. Smith SFC John C. Smith AV835-4101	2b. Typed Name, Duty Phone and Signature

Block 3. The report control number has 12 places in it. The first 6 places are your DODAAC. The next 2 places indicate the calendar year (the last two numbers of the year) while the last 4 places of the report control number indicate the number of QDRs submitted by your unit. In the example, this is the fourth QDR submitted by the battalion during the calendar year of 1986.

Block 4. Enter the dates that equipment was examined and tested.

Blocks 5 and 6. Your form should have the same NSN and nomenclature for the boresight telescope as shown below.

3. Report Control No. W33RQH004	4. Date Deficiency Discovered May-Jun '86	5. National Stock No. (NSN) 4900-00-867-6607	6. Nomenclature 5X Boresight Telescope
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QUALITY DEFICIENCY REPORT
(Category II)

SECTION I

1a. From (Originating point)		2a. To (Screening point)	
1b. Typed Name, Duty Phone and Signature		2b. Typed Name, Duty Phone and Signature	
3. Report Control No.	4. Date Deficiency Discovered	5. National Stock No. (NSN)	6. Nomenclature
7. Manufacturer/Mfg. Code/Shipper	8. Mfg. Part No.	9. Serial/Lot/Batch No.	10. Contract/PO/Document No.
11. Item <input type="checkbox"/> New <input type="checkbox"/> Repaired/ Overhauled	12. Date Manufactured/ Repaired/Overhauled	13. Operating Time at Failure	
15. Quantity	a. Received	b. Inspected	c. Deficient
16. Deficient Item Works On/With	a. End Item (Aircraft, tank, ship, howitzer, etc.) b. Next Higher Assembly	(1) Type/Model/Series (1) National Stock No. (NSN) (2) Nomenclature (3) Part No. (4) Serial No./Lot No.	
17. Dollar Value	18. Est. Correction Cost	19. Item Under Warranty <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	20. Work Unit Code/EIC (Navy and Air Force only)
21. Action/Disposition <input type="checkbox"/> Holding Exhibit for _____ days <input type="checkbox"/> Released for Investigation <input type="checkbox"/> Returned to Stock/ Disposed of <input type="checkbox"/> Reported <input type="checkbox"/> Other (Explain in Item 22)			
22. Details (Describe, to best ability, what is wrong, how and why, circumstances prior to difficulty, description of difficulty, cause, action taken including disposition, recommendations. Identify with related item number. Include and list supporting documents. Continue on separate sheet if necessary.)			

SECTION II

23a. To (Action Point)	24a. To (Support Point) (Use Items 25 and 26 if more than one)
23b. Typed Name, Duty Phone and Signature	24b. Typed Name, Duty Phone and Signature
25a. To (Support Point)	26a. To (Support Point)
25b. Typed Name, Duty Phone and Signature	26b. Typed Name, Duty Phone and Signature

Block 7 and 8. The manufacturer (Block 7) and part number (Block 8) for the telescope are shown below. The part number is read from the base plate of the telescope.

Block 9. Serial numbers of defective/inaccurate equipment will be reported in Block 22 so enter See Block 22.

Block 10. Enter UNKNOWN.

Blocks 11 and 12. If telescopes are new or have been repaired, then check this block 11. Block 12 is used to enter manufacturing/repair dates if they are known.

Block 13. Enter NA.

Block 14. Check the NO square.

Block 15. Use Block 15b to enter the number of items that were examined/tested. The number of defective and inaccurate telescopes that were detected is included in Block 15c. Blocks 15a and 15d are filled out if appropriate.

7. Manufacturer/Mfg. Code/Shipper Lenzar Optics Corp.		8. Mfg. Part No. Lenzar P/N 85-0111-9520-4	9. Serial/Lot/Batch No. See Block 22	10. Contract/PO/Document No. Unknown	
11. Item <input type="checkbox"/> New <input type="checkbox"/> Repaired/ Overhauled		12. Date Manufactured/ Repaired/Overhauled N/A	13. Operating Time at Failure N/A	14. Government Furnished Material <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
15. Quantity		a. Received	b. Inspected 60	c. Deficient 19	d. In Stock 60

Block 16. Enter the NSN of the BFV (M2) in Block 16 a(1). Enter NA in all other portions of Block 16.

Blocks 17, 18, and 19. Enter or check UNKNOWN.

Block 20. Enter the letter O since defective items were detected and reported at the organizational level.

Block 21. Check and write in HOLDING EXHIBIT FOR 45 DAYS so that defective items will be held 45 days pending disposition instructions.

16. Deficient Item Works On/With	a. End Item (Aircraft, tank, ship, howitzer, etc.)	(1) Type/Model/Series Fighting Vehicle, Infantry, M2 NSN 2350-01-048-5920			(2) Serial No. N/A
	b. Next Higher Assembly	(1) National Stock No. (NSN) N/A	(2) Nomenclature N/A	(3) Part No. N/A	(4) Serial No./Lot No. N/A
17. Dollar Value Unknown	18. Est. Correction Cost Unknown	19. Item Under Warranty <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown	20. Work Unit Code/EIC (Navy and Air Force only) 0		
21. Action/Disposition <input checked="" type="checkbox"/> Holding Exhibit for 45 days <input type="checkbox"/> Released for Investigation <input type="checkbox"/> Returned to Stock/ Disposed of <input type="checkbox"/> Repaired <input type="checkbox"/> Other (Explain in Item 22)					

Block 22. This is the most important block because it contains the details of the problem. This block presents information suggesting that a problem exists (e.g., excessive ammunition expenditure during zeroing), how the equipment was examined/tested to detect the problem (e.g., telescope rotation test), and the results of testing. If there is not enough space on the form, then another sheet headed by your Report Control Number can be included. The example below illustrates the type of information that should be presented.

22. Details (Describe, to best ability, what is wrong, how and why, circumstances prior to difficulty, description of difficulty, cause, action taken including disposition, recommendations. Identify with related item number. Include and list supporting documents. Continue on separate sheet if necessary.)

1. First indication of trouble was excessive ammunition expenditure during numerous zeroings of the 25-mm gun.
2. Deficiencies were detected during inspection and testing of boresight equipment.
3. Thirteen telescopes were unserviceable or had operational problems as follows:
 - A. Water/condensation in the telescopes: S/Ns 1043, 1484, 2134, & 2088A.
 - B. Eyepiece disassembled or assembled incorrectly: S/Ns 1050, 1176, 1807, & 2234.
 - C. Telescope dirty inside: S/N 2022.
 - D. Tube of telescope fits loosely on base: S/N 3464.
 - E. Stem that fits into adapter is bent: S/N 1240.
4. Accuracy was tested by rotating the telescope 180-degrees in a 25-mm adapter. The standard required no more than a 1-mil change in aiming point of the telescope.
5. Telescopes not meeting the standard had S/Ns of 1190, 1775, 2086, 2110, 2173, & 2254

A sample QDR for adapters is presented on the following page. Blocks 1 and 2 are the same as for telescopes. The Report Control Number is different than for telescopes because each QDR has a unique number. The NSN and nomenclature for the 25-mm adapter is shown below. The part number (Block 8) depends on the design of the adapter. The originally fielded adapter as illustrated in Section 2 has a manufacturer number of 12524010. The newly designed adapter with a chromium plated knob and tapered stop has a part number of 12524144. Items 9 through 21 are filled out in a manner similar to that used for telescopes. Block 22, the most important part of the QDR, is filled out as shown with the exception of the number of reported defective adapters (Item 4). This will be the number of defective adapters detected during your testing.

QUALITY DEFICIENCY REPORT
(Category II)

SECTION I

1a. From (Originating point) Commander, 1/29th INF ATTN: BN Master Gunner, SFC John C. Smith Fort Benning, GA 31905 W33RQH		2a. To (Screening point) Commander, US AMCCOM ATTN: AMSMC-QAD Rock Island, IL 61299	
1b. Typed Name, Duty Phone and Signature <i>John C. Smith</i> SFC John C. Smith AV 835-4101		2b. Typed Name, Duty Phone and Signature <i></i>	
3. Report Control No. W33RQH005	4. Date Deficiency Discovered May-Jun 86	5. National Stock No. (NSN) 1005-01-120-0449	6. Nomenclature 25-MM Boresight Adapter Assembly
7. Manufacturer/Mfg. Code/Shipper Unknown		8. Mfg. Part No. 12524010	9. Serial/Lot/Batch No. See Block 22
11. Item New <input type="checkbox"/> Repaired/ Overhauled <input type="checkbox"/>		12. Date Manufactured/ Repaired/Overhauled N/A	13. Operating Time at Failure N/A
15. Quantity		a. Received 60	b. Inspected 42
16. Deficient Item Works On/With		14. Government Furnished Material <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
a. End Item (Aircraft, tank, ship, howitzer, etc.) Fighting Vehicle, Infantry, M2 NSN 2350-01-048-5920		(2) Serial No. N/A	
b. Next Higher Assembly N/A		(1) National Stock No. (NSN) N/A	(2) Nomenclature N/A
17. Dollar Value Unknown		18. Est. Correction Cost Unknown	19. Item Under Warranty <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown
21. Action/Disposition <input checked="" type="checkbox"/> Holding Exhibit for 45 days		20. Work Unit Code/EIC (Navy and Air Force only) 0	22. Details (Describe, to best ability, what is wrong, how and why, circumstances prior to difficulty, description of difficulty, cause, action taken including disposition, recommendations. Identify with related item number. Include and list supporting documents. Continue on separate sheet if necessary.)

- First indication of trouble was excessive ammunition expenditure during numerous zeroings of the 25-mm gun.
- Deficiencies were detected during inspection and testing of boresight equipment.
- Adapter accuracy was tested using the kit rotation procedure. The tested adapter and an accurate telescope were rotated 180 degrees in the gun. The standard required a change in aiming point of no more than 1 mil.
- A total of 42 adapters did not meet the accuracy standard.
- Adapters not meeting standards were marked with identification numbers. They will be held for 45 days pending disposition instructions.

SECTION II

23a. To (Action Point)	23a. To (Support Point) (Use Items 25 and 26 if more than one)
23b. Typed Name, Duty Phone and Signature	24b. Typed Name, Duty Phone and Signature
25a. To (Support Point)	26a. To (Support Point)
25b. Typed Name, Duty Phone and Signature	26b. Typed Name, Duty Phone and Signature

ANNEX A

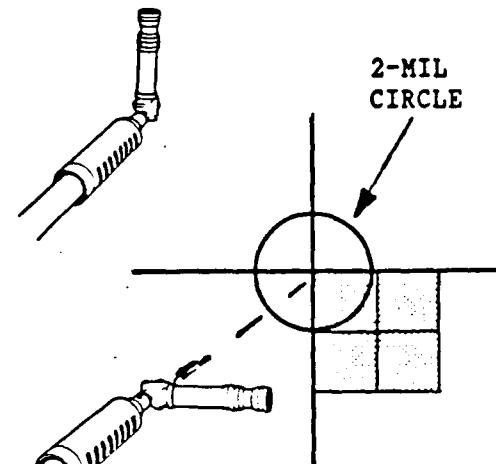
25-MM BORESIGHT KIT ACCURACY FIELD TEST

Objective. To test accuracy of the 25-mm boresight kit prior to boresighting turret-bound weapons of the BFV.

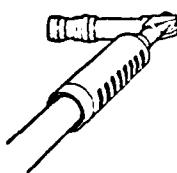
Prerequisites. Turret and 25-mm gun in manual mode, TOW in power mode, turret power on, turret drive off, travel lock disengaged, 25-mm adapter inserted into gun barrel, boresight telescope inserted into adapter, red streamer hanging from boresight equipment, telescope eyepiece facing upright, and boresight target visible through boresight telescope.

Procedure. The following procedure replaces steps 17 through 21 described under BORESIGHT 25-MM GUN in TM 9-2350-252-10-2.

1. FOCUS the telescope RETICLE using the reticle focus.
2. FOCUS on TARGET using the target objective focus.

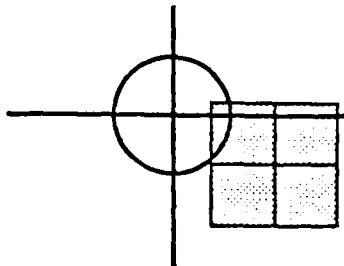


3. ROTATE TELESCOPE until EYEPIECE is FACING RIGHT.
4. INSTRUCT GUNNER to LAY GUN with TELESCOPE CROSSHAIRS on CORNER of BORESIGHT TARGET.
5. ROTATE the TELESCOPE and ADAPTER together a half turn (180 degrees) to the LEFT.

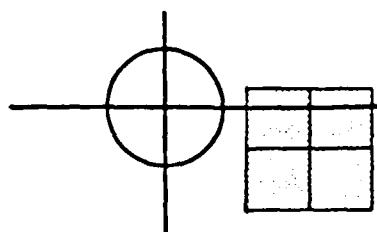


6. DETERMINE ACCURACY of equipment.

A. IF the original AIMING POINT stayed IN OR ON the 2-mil CIRCLE, then STANDARDS are MET; continue boresighting procedures described in TM 9-2350-252-10-2.



B. IF original AIMING POINT moved OUT of 2-mil CIRCLE of reticle, then STANDARDS are NOT MET; other boresight equipment should be tested for accuracy before boresight procedures are continued.



ANNEX B

SUMMARY OF TEST PROCEDURES FOR 25-MM BORESIGHT EQUIPMENT

This annex can be used as a job performance aid to test the accuracy of 25-mm boresight equipment. Testers should be thoroughly familiar with Sections 1 through 8 of this pamphlet before testing is conducted. The 4 phases of testing are summarized below. Subtasks required for each phase are described on the following pages.

Phase 1. Testing Preparation

1. Arrange for testing area, 2 testers (master gunners), and 1 BFV.
2. Prepare and position boresight test panel (Subtask A).
3. Learn the boresight aiming-point recording procedure (Subtask B).
4. Lay gun on center of test panel (Subtask C).

Phase 2. Screening adapters

1. Obtain one new or accurate telescope.
2. Mark adapters (Subtask D, Procedure A).
3. Conduct testing (Subtask E).
4. Score adapters (Subtask G).

Phase 3. Screening telescopes

1. Identify most accurate adapter scored during Step 4 of Phase 2.
2. Obtain telescopes.
3. Conduct testing (Subtask F).
4. Score telescopes (Subtask G).

Phase 4. Forming kits

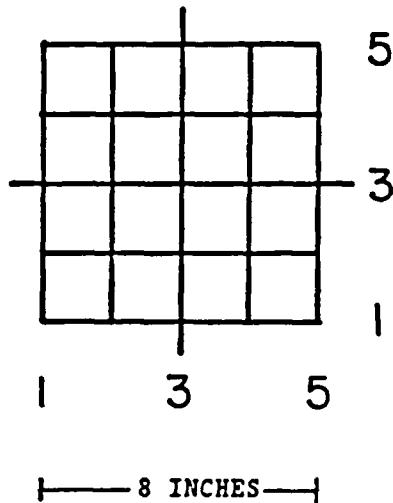
1. Collect telescopes and adapters meeting standards during Phases 2 and 3, respectively.
2. Test kits (Subtask E).
3. Mark kits that pass the test (Subtask D, Procedure B).

SUBTASK A: PREPARE AND POSITION THE BORESIGHT TEST PANEL

Objective. To prepare and position the boresight test panel for testing.

Panel Description.

The test panel has a white background. Squares on the panel are marked by solid black lines that are 1/8 inch wide. The length of each side of a square is 2 inches (5 cm). When the panel is positioned 52 meters from the end of the gun barrel, each square has a visual size of 1 mil. Numbers are from 1.5 to 2 inches tall. A half-scale copy of the target is included in Appendix A. The following describes the procedure for preparing and positioning the test panel for testing.



Procedure.

1. REMOVE the TEST GRID from Appendix B.
2. WATERPROOF the TEST GRID.
3. MOUNT the TEST GRID onto a rigid panel (e.g., plywood).
4. PLACE the TEST PANEL 52 METERS from the END of the 25-MM GUN BARREL.

SUBTASK B: BORESIGHT AIMING-POINT RECORDING PROCEDURE

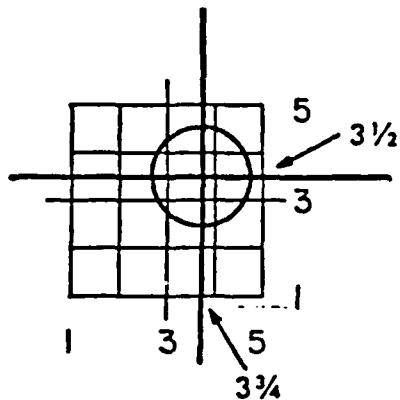
Objective. To record a boresight telescope aiming point on the boresight equipment scoresheet.

Conditions. BFV operational status: turret and 25-mm gun in manual mode, TOW in power mode, turret power on, turret drive off, travel lock disengaged, 25-mm adapter inserted into gun barrel, boresight telescope inserted into adapter, telescope eyepiece facing up, and the boresight telescope reticle aiming at the test panel. Equipment: pen or sharp pencil, and boresight equipment scoresheet (Appendix B).

Procedure.

1. ROTATE the TELESCOPE so that the reticle CROSSHairs are PARALLEL with the GRID LINES on the TEST PANEL.
2. RECORD AZ COORDINATE of aiming point as RT AIMPOINT COOR in DATA SECTION of the scoresheet.
3. RECORD EL COORDINATE of aiming point as RT AIMPOINT COOR in DATA SECTION of scoresheet.
4. PLOT the aiming point on the SCORING GRID of the scoresheet.

SIGHT PICTURE



SCORESHEET

DATA SECTION 1

RT AIMPOINT COOR: AZ 3 3/4 EL 3 1/2

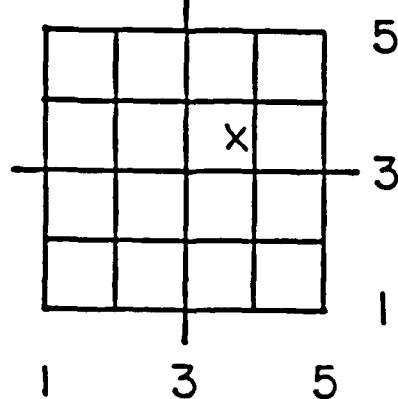
LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE
BETWEEN AIMPOINTS (IN) _____

DISTANCE IN MILS
BETWEEN AIMPOINTS _____

SCORE: GO / NO GO

SCORING GRID 1



Standard. For a given aiming point, 2 testers should have elevation and azimuth readings that are to the nearest 1/4 mil.

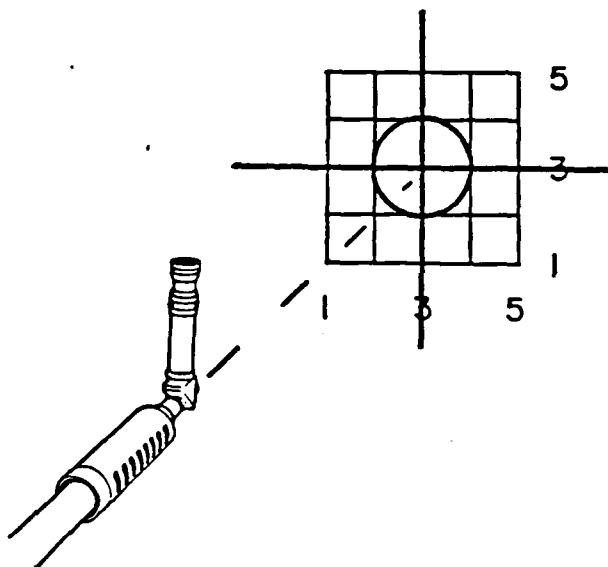
SUBTASK C: LAY THE GUN ON THE CENTER OF THE TEST PANEL

Objective. To lay the 25-mm gun on the center of the boresight test panel.

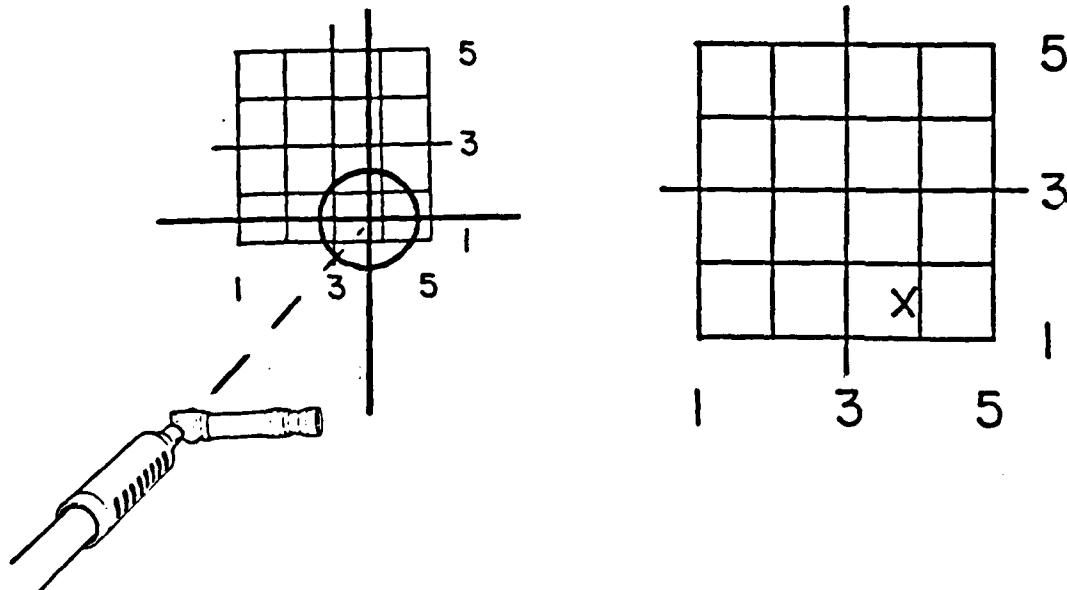
Conditions. Turret and 25-mm gun in manual mode, TOW in power mode, turret power on, turret drive off, travel lock disengaged, 25-mm adapter inserted into gun barrel, boresight telescope inserted into adapter, and test panel positioned 52 meters from end of 25-mm gun barrel.

Procedure.

1. ROTATE boresight TELESCOPE until the EYEPIECE is facing UP.
2. Instruct gunner to LAY GUN until the telescope CROSSLHAIRS AIM at TARGET CENTER.
3. FOCUS boresight TELESCOPE.
 - A. FOCUS RETICLE using reticle focus ring.
 - B. FOCUS on the TARGET using target focus ring.
4. If necessary, instruct gunner to RE-LAY GUN on CENTER of TEST PANEL.

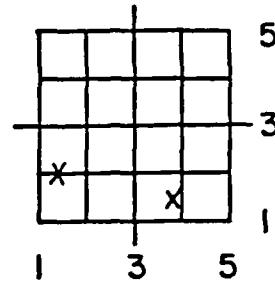
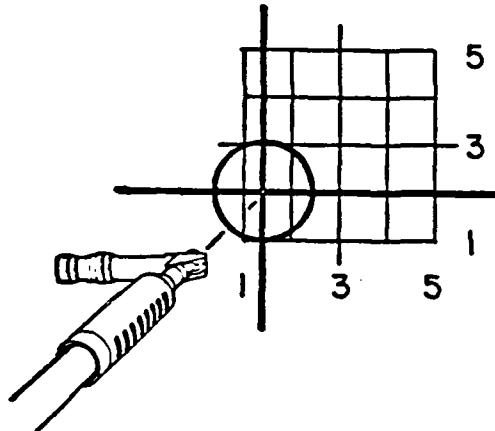


5. ROTATE the KIT (telescope & adapter) until the telescope EYEPIECE is facing RIGHT and the crosshairs run parallel with the scoring grid.
6. RECORD AIMING POINT on a SCORING GRID of the SCORESHEET using the procedure described in Subtask B.



7. ROTATE the KIT (telescope & adapter) 180 degrees to the LEFT until the RETICLE CROSSHAIRS are PARALLEL with the TEST PANEL.

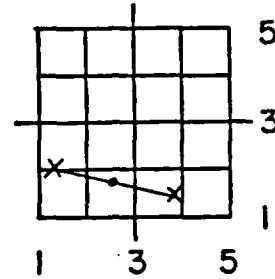
8. RECORD AIMING POINT on the SCORESHEET.



9. DETERMINE AIMING POINT of GUN.

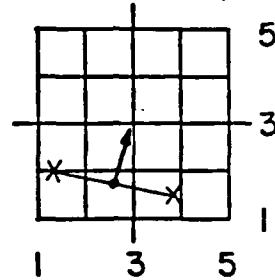
A. DRAW a LINE between the two AIMING POINTS marked on the scoresheet.

B. MARK the MIDDLE of the LINE.

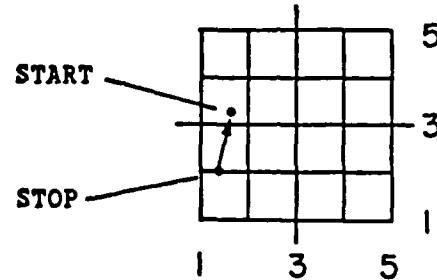


10. LAY GUN on estimated CENTER of PANEL

A. DRAW an ARROW from the MIDDLE of the LINE to the CENTER of PANEL.



- B. Instruct gunner to LAY the GUN the DISTANCE and DIRECTION shown by the arrow.



NOTE: The example shows the START and STOP points of the gun lay with the telescope starting in the left position. The gun lay can be performed with the telescope in any position (left, up, and down), but the gun is moved the same distance and direction no matter where the starting location is.

SUBTASK D: ADAPTER MARKING PROCEDURES

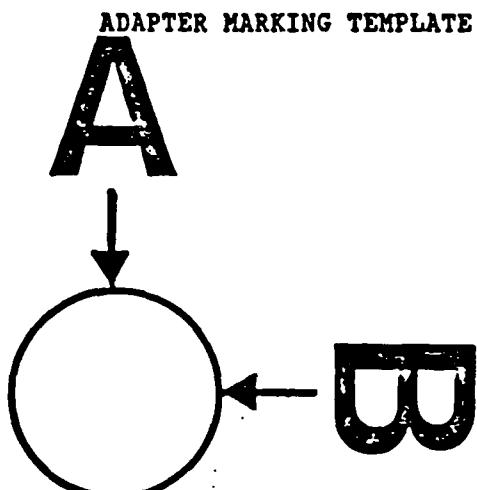
Objective. To (a) mark adapters before testing and (b) to permanently mark accurate adapters.

Equipment. Equipment required are masking tape (1 to 1 1/2 inch wide), a permamarker pen, an electrical etching tool, and adapters to be marked.

Procedure.

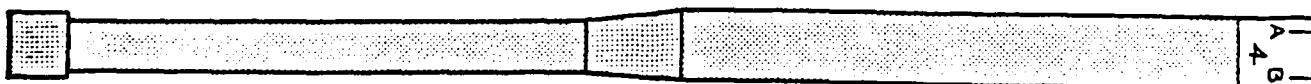
A. Marking Adapters for Testing.

1. WRAP masking TAPE around the end of the ADAPTER where the telescope is inserted.
2. DRAW POSITION MARKS A and B on the tape using the ADAPTER MARKING TEMPLATE.
 - A. PLACE TELESCOPE END of ADAPTER in CIRCLE of the template.



- B. Starting at the arrows on the template, DRAW 2 LINES on the TAPE of the adapter.
- C. LABEL lines A and B on the tape as indicated on the template
3. ASSIGN each ADAPTER in the battalion a unique NUMBER.
4. MARK the assigned ADAPTER NUMBER on the TAPE.

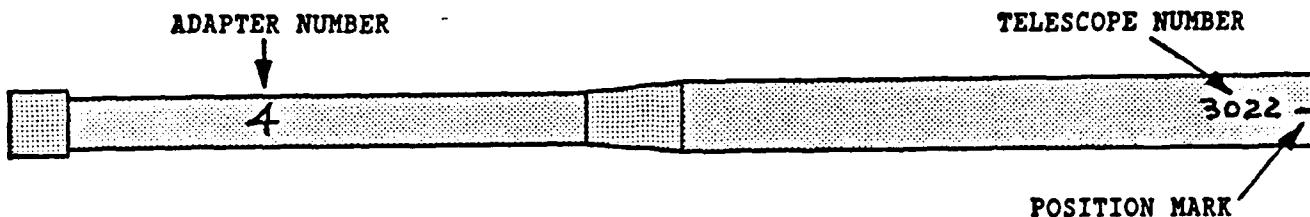
ADAPTER MARKED FOR TESTING



B. Placing Permanent Markings on Accurate Adapters.

Adapters that pass the screening criterion can then be permanently marked using an electrical etching tool.

1. ETCH the ADAPTER IDENTIFICATION NUMBER on the NECK of the adapter.
2. ETCH a POSITION MARK on the TELESCOPE END of the ADAPTER. This mark will help orient the adapter during kit rotation procedures.
3. If a particular telescope is to be permanently paired with the adapter, then ETCH the TELESCOPE SERIAL NUMBER on the TELESCOPE END of the ADAPTER.



SUBTASK E: ADAPTER AND KIT SCREENING PROCEDURE

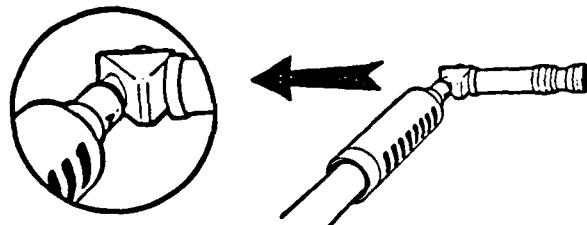
Objective. To collect accuracy data for 25-mm adapters and kits.

Conditions. Turret and 25-mm gun in manual mode, TOW in power mode, turret power on, turret drive off, travel lock disengaged, boresight test panel positioned 52 m from the end of the 25-mm gun bore, gun aimed at center of test panel, 25-mm adapters marked with identification numbers, an accurate telescope is available when adapters are being tested, and 2 Master Gunners.

Procedure.

1. RECORD date, time, tester, telescope serial number, adapter assigned number, and test type on the INFORMATION SECTION on the top of the Boresight Equipment Scoresheet.

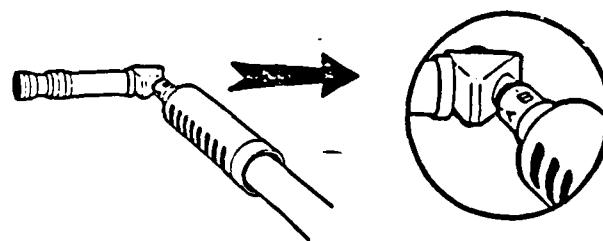
2. INSERT 25-mm ADAPTER into barrel with POSITION MARK A facing RIGHT.



3. INSERT TELESCOPE into adapter with the EYEPIECE facing RIGHT.

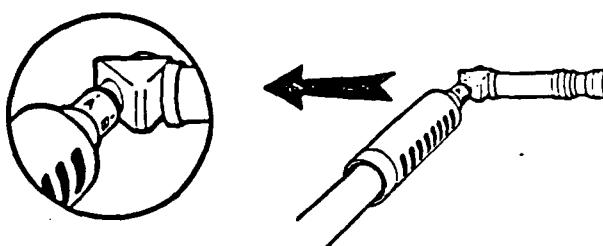
4. RECORD RT AIMPOINT of telescope on SCORESHEET.

5. ROTATE both the TELESCOPE and ADAPTER to the LEFT. Position Mark A of the adapter is facing right.



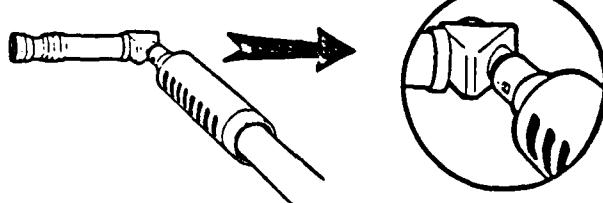
6. RECORD telescope AIMING POINT on SCORING GRID 1 of scoresheet.

7. ROTATE the kit until both the TELESCOPE and ADAPTER POSITION MARK B are facing RIGHT.



8. RECORD RT AIMING POINT on SCORING GRID 2 of scoresheet.

9. ROTATE the KIT to the LEFT. Position Mark B of the adapter is facing left.



10. RECORD LT AIMPOINT on SCORING GRID 2 of the scoresheet.

11. SCORE DATA according to Subtask G.

SUBTASK F: TELESCOPE SCREENING PROCEDURE

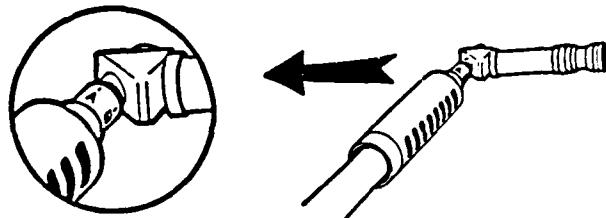
Objective. To collect accuracy data for boresight telescopes.

Conditions. Turret and 25-mm gun in manual mode, TOW in power mode, turret power on, turret drive off, travel lock disengaged, gun aimed at center of test panel, boresight test panel positioned 52 m from the end of the 25-mm gun bore, an accurate adapter, and 2 Master Gunners.

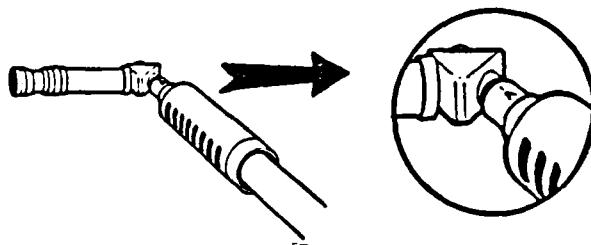
Procedure.

1. RECORD date, time, tester, telescope serial number, adapter assigned number, and test type on Boresight Equipment Scoresheet.

2. INSERT 25-mm ADAPTER into barrel with POSITION MARK A facing UP.

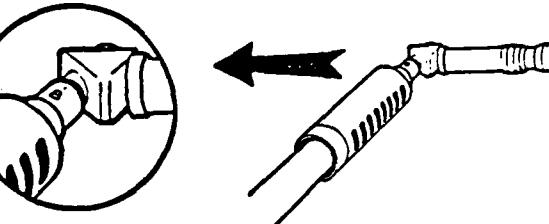


3. INSERT TELESCOPE into adapter with EYEPIECE facing to the RIGHT.



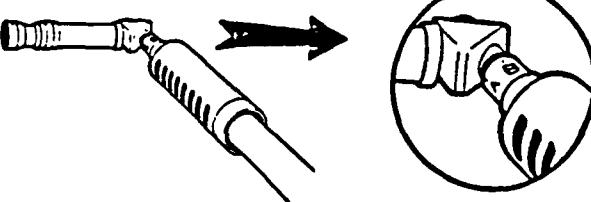
4. RECORD RT AIMPOINT in DATA SECTION 1 of SCORESHEET.

5. ROTATE only the TELESCOPE to the LEFT.



6. RECORD LT AIMPOINT in DATA SECTION 1 of SCORESHEET.

7. ROTATE the ADAPTER until POSITION MARK B is facing UP.



8. ROTATE only the TELESCOPE to the RIGHT.

9. RECORD the RT AIMPOINT in DATA SECTION 2 of SCORESHEET.

10. ROTATE only the TELESCOPE to the LEFT.

11. RECORD the LT AIMPOINT in DATA SECTION 2 of SCORESHEET.

12. SCORE ACCURACY according to Subtask G.

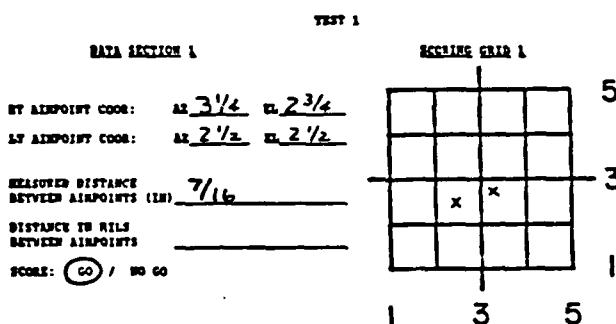
SUBTASK G: BORESIGHT EQUIPMENT SCORING PROCEDURE

Objective. To score accuracy data collected for boresight telescopes, 25-mm adapters, and 25-mm kits.

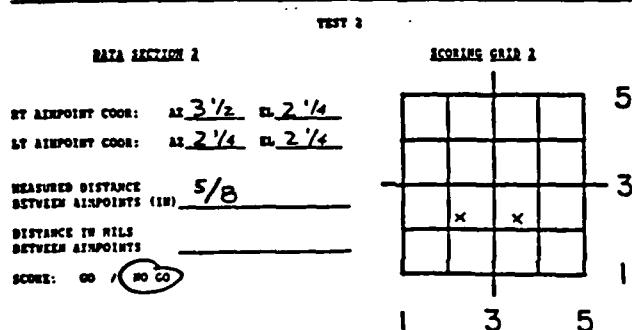
Conditions. A boresight equipment scoresheet with accuracy data recorded on it, a ruler with increments at least every 1/16 inch, and a pencil or pen.

Procedure.

1. MEASURE the DISTANCE (to the nearest 1/16 inch) BETWEEN the 2 AIMING POINTS plotted on SCORING GRID 1.
2. RECORD the measured DISTANCE (inches) on the SCORESHEET.
3. SCORE ACCURACY.
 - A. Score a GO for aiming point pairs separated by 1/2 inch or less.
 - B. Score a NO GO for aiming point pairs separated by more than 1/2 inch.



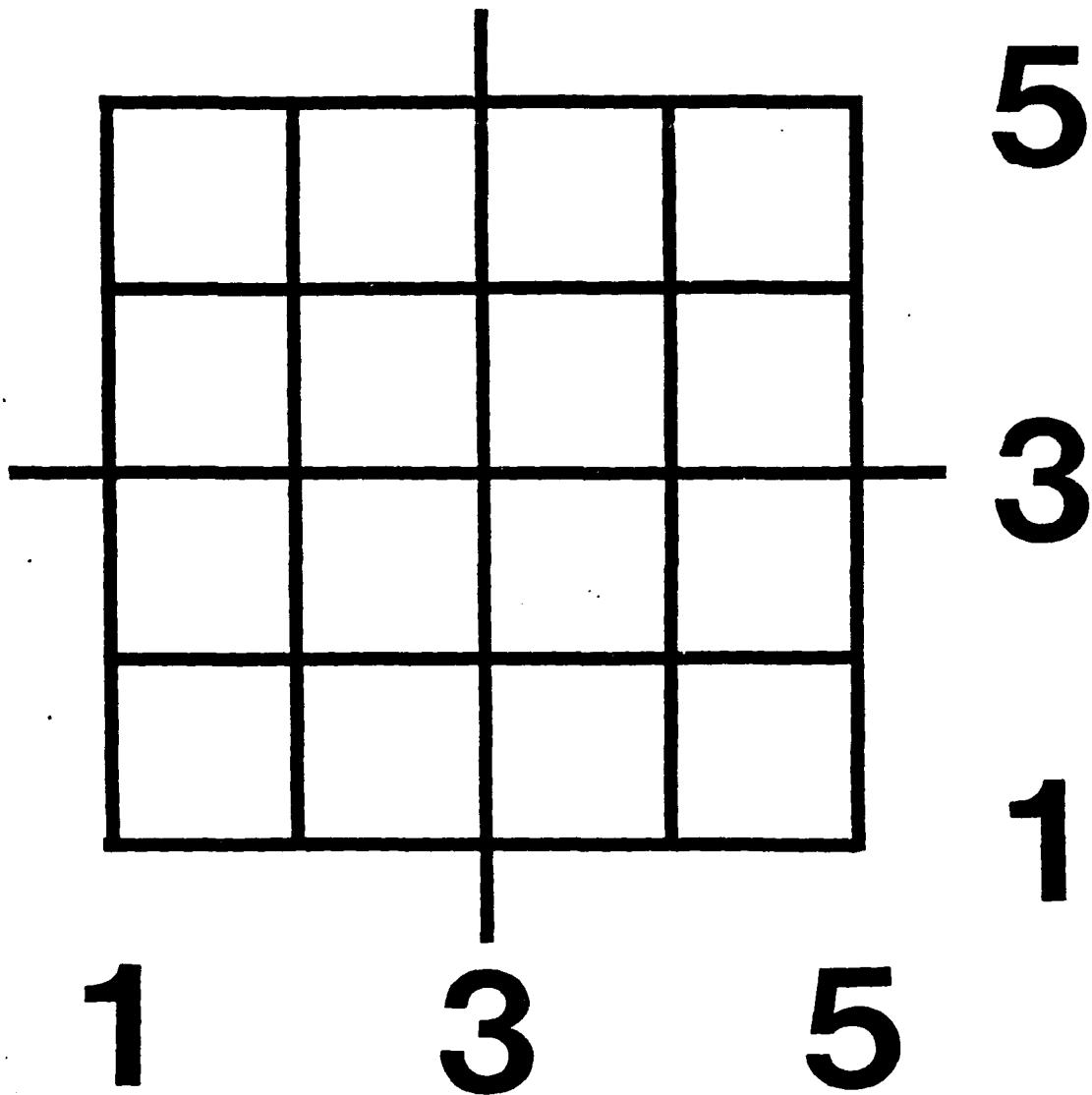
4. MEASURE the DISTANCE BETWEEN AIMING POINTS plotted on SCORING GRID 2.
5. RECORD the measured DISTANCE (inches) on the SCORESHEET.
6. SCORE ACCURACY as in Step 3.



7. DETERMINE whether EQUIPMENT PASSED or FAILED STANDARDS.
 - A. Equipment passes standards if both scoring grids are scored GOs; one or more NO GOs is scored a fail.
 - B. Circle either PASS or FAIL in the Information Section of the scoresheet.

APPENDIX A: BORESIGHT TEST GRID

NOTE: This half-size drawing must be sent to the local printing plant for a 200 percent enlargement (each square must be 2 inches by 2 inches).



NOTE: Panel must be placed 52 meters from the gun barrel so that each square is 1 mil by 1 mil as seen through boresight telescope.

APPENDIX B. BORESIGHT EQUIPMENT SCORESHEET

DATE: _____	TIME: _____	TEST TYPE: TEL. / ADP. / KIT
TESTER: _____	TEL. NO. _____	ADT. NO. _____
UNIT: _____	PASS / FAIL (Pass requires a GO on TESTS 1 & 2)	

TEST 1

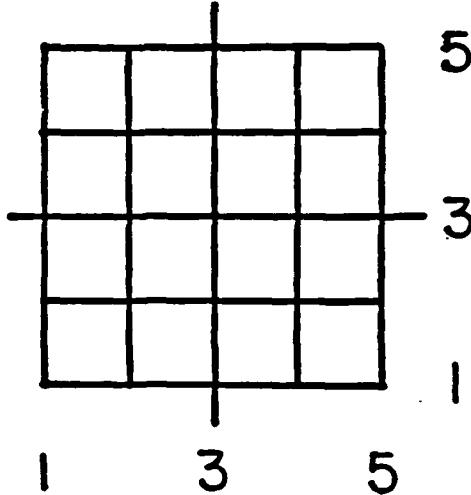
DATA SECTION 1SCORING GRID 1

RT AIMPOINT COOR: AZ _____ EL _____

LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE
BETWEEN AIMPOINTS (IN) _____DISTANCE IN MILS
BETWEEN AIMPOINTS _____

SCORE: GO / NO GO



TEST 2

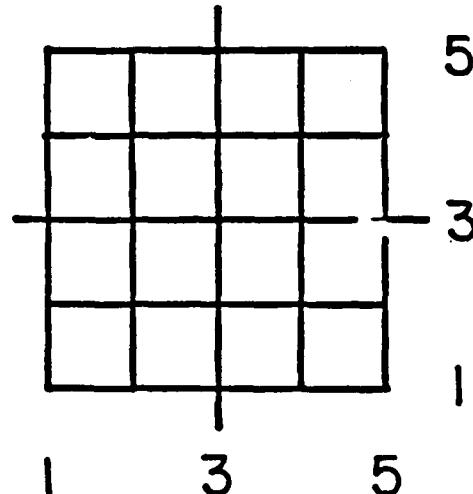
DATA SECTION 2SCORING GRID 2

RT AIMPOINT COOR: AZ _____ EL _____

LT AIMPOINT COOR: AZ _____ EL _____

MEASURED DISTANCE
BETWEEN AIMPOINTS (IN) _____DISTANCE IN MILS
BETWEEN AIMPOINTS _____

SCORE: GO / NO GO



INCH TO MIL CONVERSION TABLE FOR THIS SCORESHEET

INCHES	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1
MILS	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2

NOTE: GO Score is 1 mil or less

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